Reserve Component Contribution to Imagery Intelligence

A Monograph
by
Major Ann E. Stafford
US Army Reserve

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas
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MAJ Ann Stafford

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Approved by:

_____ Gary Phillips, COL, MMAS	Monograph Director
_____ Robert H. Berlin, Ph.D.	Professor and Director Academic Affairs, School of Advanced Military Studies
_____ Philip J. Brookes, Ph.D.	Director, Graduate Degree Program

ABSTRACT

RESERVE COMPONENT CONTRIBUTION TO IMAGERY INTELLIGENCE by Major Ann Stafford, 69 pages.

In order to determine whether Reserve Component (RC) forces are essential to the task of exploiting imagery intelligence (IMINT) and geospatial information in support of combatant commanders' operational and strategic intelligence requirements, it is important to examine IMINT within today's geopolitical and technological context. Currently, an identified shortage of imagery analysts (IA) relative to the amount of raw imagery needing exploitation has drawn national-level attention to IMINT. One of six primary intelligence disciplines, IMINT traditionally has accounted for the lion's share of intelligence-derived information since World War II. Largely due to its powerful role as an intelligence discipline, resources directed toward making technological advances in imagery collection capabilities have yielded increases in both volume and quality of imagery data. Because raw imagery has limited value until it has been exploited, the increased volume of raw imagery demands an enhanced ability for combatant commanders and the National Imagery and Mapping Agency (NIMA), the combat support agency responsible for IMINT, to effectively manage imagery exploitation assets in support of combatant commanders' strategic and operational intelligence requirements.

This monograph offers a tool, or model, that the intelligence community may use to determine and implement the most effective operational employment of RC intelligence elements in support of combatant commanders' strategic and operational intelligence requirements. The model employs concepts from linear programming, which is an asset-optimization tool developed during World War II to satisfy Air Force logistical planning requirements. The model helps categorize imagery exploitation assets and their relative capabilities and most effectively assigns these assets to the task of exploiting vast amounts of available imagery to produce the IMINT, geospatial information and imagery-derived measurement and signatures intelligence (MASINT) necessary to fulfill combatant commanders' operational and strategic intelligence requirements. The model will show how optimal use of imagery analysts—whether active or reserve, military or civilian—will maximize combatant commanders' analytical power, and therefore improve their ability to fulfill their strategic and operational intelligence requirements.

In terms of scope, RC forces account for approximately 40 percent of intelligence production in support of the combatant commands. More than 90 percent of all RC imagery analysts have deployed in the 18 months following the 11 September 2001 terrorist attacks. This study focuses on imagery analysts who are members of the ready reserve for all services, and distinguishes types of RC analysts as follows: imagery analysts who train as members of a unit, and imagery analysts who deploy in direct support of a combatant command.

To define the issues associated with RC contribution to IMINT and geospatial information requirements, and to highlight the significance of the study, the author surveyed the combatant commanders' intelligence leadership at the Joint Intelligence Centers (JIC) and Joint Analysis Centers (JAC). The study structure identifies and links the major players involved in RC contribution to combatant commanders' IMINT and geospatial information needs. Byreviewing Congressional mandates, Department of Defense (DOD) policy, technological advances, and observations of leaders within the intelligence community, the monograph shows how RC forces are essential to the task of performing IMINT and geospatial information in support of combatant commanders' operational and strategic intelligence requirements.

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CHAPTER 1

INTRODUCTION

> We have slain a large dragon, but we now live in a jungle filled with a bewildering variety of poisonous snakes, and in many ways, the dragon was easier to keep track of.[1]
>
> Mr. James Woolsey, CIA Director, 1993-1995

In order to determine whether Reserve Component (RC) forces are essential to the task of exploiting of imagery intelligence (IMINT) and geospatial information in support of combatant commanders' operational and strategic intelligence requirements, it is important to examine IMINT within today's geopolitical and technological context. Currently, an identified shortage of imagery analysts (IA) relative to the amount of raw imagery needing exploitation has drawn national-level attention to the IMINT discipline at many levels. The following overview describes the geopolitical and technological context for studying RC contribution to IMINT.

Geopolitical Context

During the Cold War, the intelligence community had a primary threat. Geographically, the threat comprised the Russian landmass and Soviet-sphere countries. Functionally, the threat involved state actors. This single threat environment allowed the United States to focus its intelligence collection and processing efforts on a discrete threat. With the downfall of the Soviet Union, however, threats to the United States became less defined and more dispersed. In response to this increasing uncertainty and dispersion, the nation's security demanded that the intelligence community monitor a larger swathe of the world's landmass and threat capabilities, thus stretching thin the resources—human and technological—required to conduct intelligence operations.

[1]James Woolsey, CIA Director 1993-1995. 1993 Senate confirmation hearing, Decision Brief, No. 93-D-14, Washington, DC, February 1993, http://www.centerforsecuritypolicy.org, accessed 4 September 2002.

At the same time, the early 1990s saw drawdowns in the military, and the intelligence disciplines were no exception. Richard K. Betts writes, "After the Cold War, intelligence resources went down as requirements went up."[2] By the later part of the 20th Century, "there was an uptick in the intelligence budget, but the system was still spread thinner over its targets than it had been when focused on the Soviet Union."[3]

One of six primary intelligence disciplines,[4] IMINT accounted for more than 90 percent of all intelligence information during World War II, and for the lion's share of intelligence-derived information since.[5] Congress has identified that IMINT served as the primary source of battlefield intelligence during the Persian Gulf War.[6] Nonetheless, relative resources for exploiting imagery-derived data have decreased in the past decade. The notion that 'a picture tells a thousand words' continues today, with members of the intelligence community reporting that President George W. Bush has, at times, requested actual annotated imagery to accompany standard written intelligence estimates. In the mid-1990s, *the Journal of Electronic Defense* published an article by John Knowles entitled, "Image is Everything." Citing operations in Somalia, Haiti, and Bosnia, Knowles explains that "everyone from the commanders to front-line warfighters want to see what is happening on the

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[2]Richard K. Betts, "Intelligence Test: The Limits of Prevention." *How Did This Happen? Terrorism and the New War*, ed. James F. Hoge Jr. and Gideon Rose (New York: Public Affairs, 2001), 147.

[3]Ibid.,147.

[4]The primary intelligence disciplines are: human intelligence (HUMINT), signals intelligence (SIGINT), measurement and signature intelligence (MASINT), electronic intelligence (ELINT), communications intelligence (COMINT), and imagery intelligence (IMINT).

[5]United States Congress, House, Committee on Armed Services, Subcommittee on Oversight and Investigations, *Intelligence Successes and Failures in Operations DESERT SHIELD/STORM.* 103d Congress, 1st Session, August 1993, 23.

[6]Ibid., 23.

ground."[7] In reference to today's increased volume of available imagery, he writes "all of this IMINT collection calls for a corresponding capability to process, exploit and archive the product efficiently."[8]

Technological Advancements

Largely due to its powerful role among the intelligence disciplines, resources directed toward technological advances in imagery collection capabilities have yielded increases in both volume and quality of imagery data. Because raw imagery has little value until it has been exploited, the increased volume of raw imagery demands a commensurate ability to exploit the imagery in order to turn it into intelligence. To highlight this point, many have attributed the failure of the intelligence community to predict the 11 September 2001 World Trade Center and Pentagon attacks to the overwhelming volume of raw data collected, coupled with a shortage of analysts to process that data into useable, or actionable, intelligence. While limitations relative to the exploitation of IMINT and geospatial information alone do not cause intelligence failure, the intelligence community's limited ability to exploit raw data is among the many factors that hinder its potential capability to detect the many-faceted threats in an increasingly complex geopolitical environment. The ever larger gap between the amount of raw data and resources to exploit that data is especially prevalent in the IMINT discipline, where ongoing enhancements in imagery architecture are magnifying volume and quality (and therefore value) of raw information available for processing. At the same time, greater image quality has increased the value, and thus the demand for exploited imagery.

National Security Context

To add further complexity to the problem, the intelligence community previously operated in a threat-based environment, which allowed it to focus its imagery collection and processing efforts on discrete regions and state-actors who potentially posed a threat to the United States. The intelligence

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[7]John Knowles, "Image is Everything (Demand for More Imagery Intelligence)," *Journal of Electronic Defense* 19, no. 5 (May 1996), 35.

[8]Ibid., 35.

focus was on "whom." Threat-based intelligence largely involved studying equipment, facilities, and order of battle. Changes in the world order, however, require closer examination of "how" our country might be threatened. Terrorism, the increasing influence of non-state actors, asymmetric threats, and changing demographics require that we not only examine "who" threatens us, but more significantly, "how" we are threatened. This new emphasis on "capabilities-based" intelligence requires greater flexibility. It requires "a force that is capable of dealing with many unknowns."[9] This force includes military—active and reserve components—and civilian contributors to national defense.

A Central Intelligence Agency (CIA) study explains that "changes in the national security environment, the revolution in information technology, and a smaller analytic work force have intensified the competition for analytic resources to meet both long-term priorities and near-term requirements."[10] In short, "the challenges to our national security" have become "more numerous, more diverse, and…more difficult."[11]

Military Transformation and Reserve Components

To address a rapidly changing world environment, and to ensure flexibility of response to ill-defined and unpredictable enemy capabilities, as well as the will of our enemies to implement those capabilities, the military is undergoing a formal transformation process. Transformation of the military is designed to better match equipment, resources, technology and doctrine to meet current and emerging threats and enemy capabilities. As part of this effort, the *2001 Quadrennial Defense Review (2001 QDR)* called for a continuing reliance on reserve component (RC) forces to address national

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[9]Office of the Assistant Secretary of Defense for Reserve Affairs, *Review of Reserve Component Contributions to National Defense* (Predecisional Working Draft) (Washington, DC: GPO 26 September 2002), viii.

[10]Central Intelligence Agency. ADCI/AP 2000-01, *Strategic Investment Plan for Intelligence Community Analysis* [document on-line]; available from http://www.cia.gov/cia/publications/unclass_sip/UnclasSIP_noblank pages.html; Internet; accessed on 16 December 2002.

[11]Report of the Independent Commission on the National Imagery and Mapping Agency, *The Information Edge: Imagery Intelligence and Geospatial Information in an Evolving National Security Environment* (Washington, DC: GPO, December 2000), 11.

security requirements. RC forces fall under two categories: the reserve of each of the services—Army, Air Force, Navy, Marines, and Coast Guard, and second, the Army and Air National Guard of each state. Building on recent assessments of RC capabilities, the *2001 QDR* "highlighted emerging roles for the reserve components in the defense of the United States, in smaller-scale contingencies, and in major combat operations." Furthermore, the *QDR* directed the Department of Defense (DOD) to "undertake a comprehensive review of active and reserve mix, organization, priority missions, and associated resources: in order to "ensure the appropriate use of the reserve components."[12] Because intelligence specialists in all services are considered "high demand, low density resources,"[13] this focus on evaluating the optimal mix of reserve and active component forces is a theme that resonates throughout each of the military services' intelligence communities, and specifically in the IMINT and geospatial information communities.

The RC is especially significant to military intelligence transformation because the RC comprises more than 43 percent of all intelligence assets. Further, in the Army alone, 98 percent of all reserve intelligence personnel, in the 18 months following the events of 11 September 2001, have been deployed in support of Operation Enduring Freedom.[14] The deployment figure for all services is more than 90 percent within the RC intelligence community.

Even more importantly, since the Vietnam War the American public has demanded that citizen soldiers serve alongside active duty forces during times of armed conflict. This mixing of reserve and active forces lends legitimacy and public support for the nation's military endeavors. Without RC contribution to defense matters, national will to participate in armed conflict becomes a critical vulnerability. Additionally, *posse comitatus* restrictions generally prohibit Title 10 military

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[12]Department of Defense, *Quadrennial Defense Review Report* (Washington, DC: GPO, 30 September 2001), 17.

[13]Robin Meyer, Commander, U.S. Navy, Director of Reserve Component Congressional Three-Year Study, Joint Forces Command, Norfolk, VA, interview by author, 24 November 2002, Washington, DC.

[14]Colonel Larry Hamara, U.S. Army, G-2, United States Army Reserve Command, telephone interview by author, 14 March 2003.

personnel from participating in law-enforcement duties within the United States. Both the active duty and the reserve forces fall under Title 10 restrictions. Uniquely, Title 32 laws allow the Army and Air National Guard elements of the RC to perform law enforcement duties within the United States. Following the events of 11 September, for example, it was the National Guard, operating under Title 32, that provided airport security. In light of the changing world situation, RC forces are integral to the transformation plans of all services. The events of 11 September promoted increased attention on homeland security, and highlighted the importance of the National Guard element of the RC as vital to national security. As Air Force Lt. Gen. Russell C. Davis, explains, "under Title 32, there is tremendous state and federal potential as a tool for the war on terrorism."[15]

Congressional Mandate

The timing of this monograph is significant not only in light of changes in the world environment and technological advances in imagery collection capabilities, but also because Congress is currently reviewing the operational employment of RC intelligence structures in support of the combatant commanders. Consistent with transformation plans of the services, in July of 2002, Congress specifically mandated that the Secretary of Defense determine

> The most effective peacetime structure(s) and operational employment of the Reserve Component (RC) Intelligence Elements in meeting current and future Department of Defense (DOD) peacetime operational intelligence requirements and to establish a means to coordinate and transition that peacetime intelligence operational support network into use for meeting wartime requirements.[16]

The intelligence community is currently completing the first year of a three-year test program to fulfill this congressional requirement. This monograph will offer a tool that the intelligence community may use to determine and implement the most effective operational employment of RC IMINT and

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[15]Russell C. Davis, Lieutenant General, U.S. Air Force, http://www.defenselink.mil/news/Feb2002/n02282002_200202282.html, 28 February 2002.

[16]Secretary of Defense, *Public Law 106-398, Section 576*, Test Program: Reserve Component Intelligence, *Transforming an Engaged Force: First Interim Report*, FOUO, 1 July 2002, 1.

geospatial information assets in support of combatant commanders' strategic and operational intelligence requirements.

In light of a dramatically changed post Cold-War threat environment, militarydrawdowns, technological advances in imagery data, and DOD focus on RC integration, this monograph examines the importance of looking to the RC to help fill the gap between available imagery data and the need to exploit that imagery so it becomes useable IMINT, MASINT and geospatial information. Specifically, the monograph seeks to determine whether RC forces are essential to the task of exploiting imagery intelligence and geospatial information in support of combatant commanders' operational and strategic intelligence requirements.

Commanders of the Joint Intelligence Centers (JIC) and Joint Analysis Centers (JAC)[17] at each of the nine combatant commands have confirmed the importance of such a study. A survey administered at the Defense Production Intelligence Conference in October 2002 revealed that JIC commanders believe that "reserve contribution to combatant commands' operational and strategic IMINT requirements is an important topic to study."[18] With the need for study verified, this monograph offers a tool, or model, for optimizing the mixture of reserve forces, active forces, plus DOD civilians and others involved in imagery analysis within the "complex adaptive system"[19] of the United States military and its efforts to adapt to a rapidly changing world environment. The model—an asset optimization tool that has its roots in post-World War II Air Force planning—allows for

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[17]Joint Intelligence Center (JIC) or Joint Analysis Center (JAC) is the analytical intelligence arm at each of the regional combatant commands. For the remainder of this study, the acronym "JIC" will refer to a combatant commander's analytical intelligence center, regardless of whether it goes by the term JIC or JAC. While the JIC focuses on intelligence analysis, the J2 at each of the combatant commands focuses on intelligence policy for the combatant commander.

[18]Survey. "Combatant Command J2/JIC IMINT Survey," Instrument developed by author, conducted by Mr. Patrick Neary, Research Director for Directorate of Analysis and Production, Defense Intelligence Agency, 26 September 2002, Question #30. (Mr. Neary administered the survey at the Defense Production Intelligence Conference in October 2002. The survey drew a 100 percent response rate.)

[19]Peter M. Senge. *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday, 1994).

integration of geospatial information and imagery-derived measurement and signature intelligence (MASINT) with traditional imagery analysis.

This integration of IMINT, geospatial information, and imagery-derived MASINT is becoming increasingly important to the IMINT community's ability to analyze intelligence and to make it more immediately useful to combatant commanders and national-level policymakers. The proposed asset optimization tool uses a matrix to categorize imagery exploitation assets and their relative capabilities for the purpose of achieving the most effective exploitation of vast amounts of available imagery data necessary to fulfill combatant commanders' operational and strategic intelligence requirements. The matrix is then applied to a model that shows how optimal use of imagery analysts—whether active or reserve, military or civilian—will maximize combatant commanders' analytical power, and therefore improves combatant commanders' ability to meet their strategic and operational intelligence requirements.

CHAPTER 2

METHODOLOGY

This research has revealed a threefold explanation for the need to bolster the imagery exploitation capabilities in support of combatant commanders' strategic and operational intelligence requirements. First, world events over the past decade and a half have triggered an increased need for imagery-derived intelligence products. Second, technological developments have led to increased collection capabilities which have made available vast amounts of imagery available for exploitation—imagery unprecedented both in volume and in quality. Third, the number of trained personnel available to exploit imagery has decreased significantly relative to combatant commanders' IMINT and geospatial information requirements. The following section introduces and examines the IMINT production cycle to pinpoint the location of the problem within the context of IMINT processes. Additionally, this chapter describes the process for addressing the question whether RC forces are essential to the task of exploiting imagery in support of combatant commanders' operational and strategic intelligence requirements.

IMINT Production Cycle

As with each of the intelligence disciplines—human intelligence (HUMINT), signals intelligence (SIGINT), electronic intelligence (ELINT), communications intelligence (COMINT), and measurement and signatures intelligence (MASINT)—IMINT has a production cycle that helps organize the process the intelligence community uses to determine what raw imagery gets collected, analyzed and disseminated. In order to focus more directly on the problem of limited analytical expertise relative to the increasingly complex international context in which combatant commanders must operate, it is important to understand the IMINT production cycle, or TPED, which stands for tasking, processing, exploitation, and dissemination.[20] TPED is a series of steps that, collectively,

[20]The intelligence community is working toward making the processing time for intelligence more effective and immediately responsive to policymakers by increasing the visibility, accessibility and analytical

constitute the National Imagery and Mapping Agency's (NIMA) role in the IMINT and geospatial information process.[21] NIMA is the combat support agency responsible for IMINT, geospatial information and imagery-derived MASINT in support of national security objectives. Figure 1 displays the intelligence production cycle, or TPED. The exploitation step is the focus of this study.

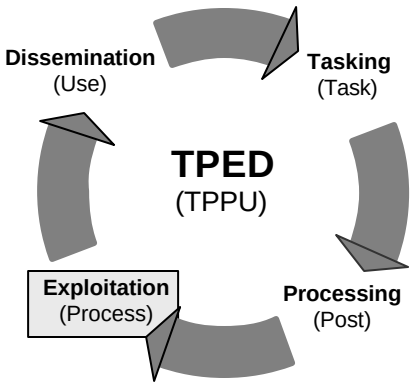

Figure 1: TPED/TPPU

The first letter of TPED stands for tasking. Imagery tasking relates to what information gets collected, and feeds what eventually will be available for exploitation. Processing, or "P," "is the link in the chain that transforms imagery 'data' into 'information' accessible to human analysts"[22] so that it may be ready for exploitation. Exploitation, or "E," is the process of translating imagery information into IMINT, geospatial information, or imagery-derived MASINT. The exploitation step is central to the IMINT production cycle, because it is where the raw imagery data, or imagery-derived information, gets transformed into intelligence. Dissemination involves making relevant IMINT available to consumers, who include the commanders of the JICs at each of the nine combatant commands.

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input into intelligence. In this spirit, "TPPU" will likely replace "TPED" to describe the IMINT cycle. TPPU stands for task, post, process, and use. The TPPU term "process" will replace the term "exploitation" in TPED. For the sake of consistency, this study will use TPED terminology.

[21]Report of the Independent Commission on the National Imagery and Mapping Agency, 69-70.

[22]Ibid.,72.

Each of the JICs maintains a staff of imagery analysts responsible for exploiting raw imagery and turning it into IMINT, which then may be combined with intelligence from other disciplines into more reliable and comprehensive all-source intelligence. This process ultimately provides the robust analytical intelligence power to satisfy the combatant commander's strategic and operational intelligence requirements.

Highlighting the importance of the exploitation step of TPED, a recent survey of the JIC commanders significantly revealed that imagery exploitation is the element of TPED "that will demand the greatest increase or improvement of resources over the next 5-10 years."[23] With this in mind, several initiatives have begun to address issues hindering the process of imagery exploitation. These initiatives include technical, educational, and organizational efforts to bolster the collective power of imagery exploitation assets. For the sake of this study, exploitation assets include both humans and automated resources, or assets available to the JIC commander for exploiting imagery data. While it is important to recognize that advances in technology may help categorize and filter imagery data to facilitate the exploitation process, it is the trained and skilled human exploitation asset that ultimately turns raw imagery data into intelligence, thus producing a valuable IMINT product to meet the combatant commander's requirement for strategic and operational intelligence. For the sake of better understanding the process, the next paragraphs provide examples of how technology may help make the exploitation phase of TPED more efficient. Nonetheless, the primary focus of this monograph remains the human exploitation assets.

An example of a technical response for more efficient handling of imagery data is the Video Acquisition and Enhancement System (VAES). Prior to year 2000, raw imagery had to be transferred from one system to a hard-copy image or to an analyst's monitor in order for that image to be exploited. By early 2000, however, "it became technically feasible to deliver imagery directly from a

[23]Survey, #6.

sensor or camera to an analyst's monitor."[24] This helped shorten the time between the processing and the exploitation stages of TPED. Furthermore, technology is currently being developed to automatically conduct elements of exploitation operations, such as "change detection."[25] Presumably, increased automation will help increase the productivity of imagery analysts (IAs) by helping them to exploit more of the imagery-derived data requiring a skilled and trained IA, or human exploitation asset.

In a parallel effort to facilitate IAs' ability to more efficiently and effectively access imagery to be exploited, NIMA is working on a process whereby imagery analysts will be able to directly interface with a single imagery database, rather than with a variety of systems. A recently published government report "suggests that TPED itself migrate in structure toward a data-centric, world wide web-centric design."[26] This ability to directly access data will simplify an IA's ability to process imagery ready for exploitation. This will bring greater efficiency to the exploitation process, which, in turn, will allow IAs to exploit greater amounts of imagery information and turn it into useable intelligence and geospatial information.

Even with technical and organizational developments for imagery processing and exploitation in the works, imagery exploitation still requires trained personnel with access to equipment and databases who can exploit imagery so it will be useful to a combatant commander. The challenge from a human resources perspective, however, is that the number of IAs relative to the amount of imagery needing to be exploited has decreased over the years while the volume of imagery data has increased. Citing the challenges of new technologies and the lack of resources for exploiting imagery data, the House of Representatives Permanent Select Committee on Intelligence has determined that "all of these problems hinge on the number of available analysts. Hence, we must act quickly to

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[24] "Technology Speeds Intelligence Imagery," *Signal* 55, no. 2 (October 2000), 35.

[25] Report of the Independent Commission on the National Imagery and Mapping Agency, 102.

[26] "Government Reorganization May Fortify Space Security," *Signal* 55, no. 8 (April 2001), 60.

increase the number of imagery analysts, both national and military."[27] While this call to action is intended to alleviate the current problem of IA shortage, this monograph offers an alternative solution to the problem of limited ability to satisfy intelligence requirements during the exploitation phase of the TPED cycle. What is needed is better management of the IAs, or the exploitation assets we currently have, in order to meet the nation's security needs. As Richard Betts writes, it is easy to "throw money at the problem" by attaining more resources, but as he suggests, this is not necessarily the most effective solution to the problem.[28]

The bottom-line problem is that the amount of output by all available imagery intelligence exploitation assets, called variable ***Y***, *is less than* the amount of output needed to satisfy combatant commanders' total strategic and operational IMINT requirements, or variable ***Y'***. Algebraically, the problem looks like this:

$$\sum Y < \sum Y'$$

Where: ***Y*** = the amount of output by all imagery intelligence exploitation assets, and

> ***Y'*** = the amount of output needed to satisfy combatant commanders' IMINT and geospatial information requirements.

This algebraic expression of the core problem statement will be developed in the recommendations section of this study in order to provide a tool for decreasing the gap between ***Y*** and ***Y'***.

With the need for improving the exploitation element of TPED identified, and with precedent set for looking to the RC for support, this monograph will specifically examine how to bolster the exploitation element of TPED in order to meet combatant commanders' requirements for operational and strategic imagery intelligence.

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[27]Permanent Select Committee on Intelligence, House of Representatives, Staff Study, *IC21: Intelligence Community in the 21st Century* 9 April 1996, [document on-line]; available from http://www.access.gpo.gov/congress/house/intel/ic21/ic21006.html, accessed 29 November 2002.

[28]Betts, 146-7.

Process

With the problem of a lack of exploitation assets identified, the next step is to identify key players involved in IMINT and to define relevant IMINT terminology. Next, we will consider a CIA-proposed matrix as a conceptual basis for distinguishing and establishing intelligence priorities within combatant commands, and apply the matrix to a linear programming model to arrive at a solution for solving the problem of a shortage of imagery analysts. The ultimate recommendation fulfills efforts to improve efficiency and effectiveness of limited manpower assets in order to support national security requirements, which, in this case, we define as combatant commanders' strategic and operational intelligence requirements. To accomplish this objective, the monograph will cite information from the following sources—a survey of JIC commanders, interviews with key personnel, reviews of business concepts, and quotes from DOD memoranda and policies.

To achieve collective firsthand perceptions of IMINT within the combatant commands, the author developed a survey to better define JIC commanders' impressions of RC forces, NIMA's contribution to the IMINT process, and the status and future of the RC role in IMINT. At the Defense Intelligence Production Conference in September of 2002, attended by JIC commanders and their representatives, Mr. Pat Neary of the Defense Intelligence Agency (DIA) administered the survey. While individual answers are kept anonymous, a copy of the survey and collated raw data is included in appendix A: Combatant Command – J2/JIC IMINT Survey. One hundred percent of the JIC representatives of each of the combatant commands responded to the survey. The data analysis tool SPSS was used to cross-tabulate data and to determine its significance.[29]

To ensure the study reflects the latest processes and visions for imagery analysis, the author interviewed more than two dozen professionals at DOD, NIMA, and the combatant commands. Interviews were conducted over the telephone and face-to-face. The bibliography reflects those

[29]Marija J. Norusis, *SPSS 11.0 Guide to Data Analysis* (Saddle River, NJ: Prentice Hall, 2000).

interviews and this monograph largely reflects the author's assimilation of their thoughts and experiences.

Directives, doctrine, and planning guidance ground this study in terms of needs and relationships. These include the QDRs, Joint Chiefs of Staff publications, Reports of House Select Committee on Intelligence, CIA Strategic Vision report, Title 10 of the U.S. Code, Secretary of Defense Directives, NIMA Commission studies, and Congressional mandates.

The study identifies and articulates the relationships among the major players involved in the process of RC contribution to combatant commander's IMINT and geospatial information needs. At the same time, the methodology builds on the description of the geopolitical situation, technological advances, and the exploitation element of TPED in order to better understand the question of whether RC forces are essential to the task of exploiting IMINT and geospatial information in support of combatant commanders' strategic and operational intelligence requirements.

With the problem algebraically defined as $\sum \boldsymbol{Y} < \sum \boldsymbol{Y'}$ and with a methodology for study identified, the next section identifies and describes each of the three major players involved in IMINT and geospatial information relative to RC contribution to combatant commanders' strategic and operational intelligence requirements. Next, the monograph will describe an asset utilization model that will help optimize the contribution of the RC as well as the active component and other contributors to imagery exploitation in support of the combatant commanders.

CHAPTER 3

DEFINITIONS & RELATIONSHIPS

As the previous paragraphs describe, imagery-derived intelligence and its importance to national security is greatly affected by a variety of factors—a changing world situation, advances in intelligence-collection capabilities, military drawdowns of the previous decade, military transformation plans, and increased demands for IMINT and geospatial information. Additionally, the importance of the RC and its contribution to the intelligence community is an ongoing focus of DOD, as well as Congress. The following section describes imagery-derived intelligence disciplines and explores processes and issues that will help determine the relevance of the RC to combatant commanders' operational and strategic IMINT requirements. While this section separately defines IMINT, geospatial information, and MASINT, the remainder of the study will use the term IMINT to encompass all of these disciplines that form intelligence from imagery-derived raw data.

Definitions

Imagery Intelligence

IMINT is intelligence derived from the exploitation or analysis of data collected by visual photography, infrared sensors, lasers, electro-optics, and radar sensors. This data is processed into information, making images available in hard copy, electronically on film, or on electronic display devices,[30] and ready for exploitation. It is the exploited information that turns raw imagery into IMINT. All military services use the term imagery analyst (IA) to describe the basic skill set required to exploit imagery data. As previously mentioned, this monograph more broadly uses the term exploitation asset to describe a human or automated system capable of exploiting raw imagery data and turning it into intelligence.

[30]Training and Doctrine Command (TRADOC), TRADOC Pam 525-41, *Military Operations: Concept for Army Imagery and Geospatial Information Services* (Fort Monroe, VA: GPO, Department of the Army, 10 July 2001).

Geospatial Information

Geospatial information involves the exploitation of "geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, andtoponymic" information that is referenced to a precise location on the earth's surface.[31] Geospatial information "provides the basic framework for battle space visualization" by combining information from multiple sources and presenting it in the form of printed maps, charts, or photography.[32] Typically, topographic engineers exploit the imagery data that becomes the geospatial information a combatant commander uses in planning and execution efforts. Geospatial information is "a combat multiplier enabling the commander to make more timely and precise decisions."[33]

IMINT and geospatial products assist the combatant commands at all levels of operational and strategic campaign planning. Planning for mobilization, intelligence preparation of the battlefield (IPB), targeting, battle damage assessment (BDA), navigational routes, airfield usability, drug trafficking, visualization of urban terrain, anticipation of famine, and indications and warning (I&W) are all examples of uses for IMINT and geospatial information. As part of the larger effort toward military transformation, the Army is embracing this important imagery-derived combat multiplier as part of the Army Imagery and Geospatial Information and Services (AIGIS) concept.

AIGIS is significant because of the military's increasing reliance on information as part of its overall transformation. In fact, a significant element of the interim force under army transformation includes substituting heavy and well-armored tracked vehicles with lighter, more agile "Stryker" vehicles. Cold War doctrine had emphasized armored maneuver vehicles that were able to withstand a first-strike and continue fighting. Due to their weight and size, however, these heavy armored vehicles were cumbersome to transport to a theater of operations. New doctrine responds to an anticipated

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[31]Ibid.

[32]Ibid.

[33]Ibid.

need for vehicles that are lighter and smaller, and thus may be transported in greater numbers to a theater in a shorter amount of time. The obvious problem, however, is that the new Stryker vehicles are less fortified than the heavier Bradley infantry fighting vehicles and Abrams tanks. The Army is relying on the intelligence community to limit risk of enemy first-strike opportunity by using intelligence to locate and identify a hostile enemy before the enemy has the range and capability to successfully target friendly vehicles. Thus, the new Stryker brigades, which are leading the transformation of ground operations, "will depend heavily upon information technology and enhanced intelligence, surveillance, and reconnaissance capabilities, to compensate for their lack of armored protection."[34] The combining of IMINT, geospatial information, and imagery-derived MASINT under the AIGIS concept attempts to address this challenge. Consistent with transformation concepts, the AIGIS concept anticipates that "by 2010, information superiority will be the result of an all-source integration of imagery and imagery intelligence, geospatial information and survey support and other sources of information."[35]

Measurement and Signatures Intelligence

The IMINT community is increasingly incorporating imagery-derived elements of MASINT into its processing and integration of intelligence.[36] MASINT is the newest of the intelligence disciplines. It straddles strict intelligence discipline definitions and has a greater scientific focus than the traditional disciplines. Using highly refined and scientific analytical techniques, MASINT can help identify specific weapons systems, chemical compositions, and material content, as well as a potential adversary's ability to employ such weapons. Imagery-derived MASINT includes infrared, synthetic aperture radar, and hyper-spectral imagery.

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[34]Peter J. Boyer, "A Different War: Is the Army Becoming Irrelevant?" *The New Yorker*, 1 July 2002, 61.

[35]TRADOC Pam 525-41.

[36]Edwin Hansen, Northrup-Grumman Information Technology, Army Intelligence Master Plan, Department of the Army G-2, interview by author, 26 November 2002, Washington, DC.

Advances in MASINT's contribution to intelligence fusion highlight the increasing relevance of imagery-derived intelligence to a changing geopolitical situation, as well asMASINT's potential contribution to the technologies supporting military transformation within the services. Exploitation of imagery-derived MASINT directly affects the combatant commanders' operational and strategic intelligence capabilities by expanding the variety of intelligence inputs to improve the accuracy of all-source analysis. Technological advances within MASINT are happening concomitant with technological advances in imagery collection capabilities, in terms of both quality and quantity of imagery. Exploitation assets for MASINT are also limited, and the problems affecting IMINT exploitation are also seen in MASINT exploitation.

Future Imagery Architecture

Future Imagery Architecture (FIA) is the process which is increasing the volume and quality of imagery available for the development of IMINT, MASINT, and geospatial products. With improvements in FIA, most leaders in the intelligence community anticipate an even greater demand for imagery analysts. To confirm this, virtually all JIC commanders anticipate that "Future Imagery Architecture (FIA) and other collection enhancements, plus the increased demands on TPED…will require greater reserve contribution to IMINT."[37] Colonel Ron Haygood, the commander of the SOUTHCOM JIC, explains that with new systems and upgrades, "everyone predicts a flood of imagery will be available, and we are going to need people to exploit this imagery."[38]

One of the difficulties with the introduction of new technologies and systems into the IMINT market, however, is that these new tools need testing. The House Select Committee Report has identified that "another issue is the availability of analysts for the testing of new tools, products, etc. It is currently very difficult to pull analysts off-line for this purpose because there is no margin left in the

[37]Survey, # 8.

[38]Colonel Ronald Haygood, Air Force, Commander, Joint Intelligence Center SOUTHCOM, telephone interview by author, 20 November 2002.

number of analysts doing the day-to-day work."[39] Reserve component IAs potentially have a role in testing new tools in place of active duty analysts already engaged in theater.

With advances in FIA, RC contributions to IMINT and geospatial information will become increasingly important. This is significant because the recommendation contained in this monograph offers options for adjusting variables that may change due to technological advancements such as FIA, to increased demands on the IMINT production cycle, or to changing mission requirements and command responsibilities.

Significant Elements of Study

The construct known as "ends, ways, and means"[40] will serve as a "mental model"[41] for studying this topic. Scholars of military decision making have used the term "ends, ways, and means" in the context of a "national security strategy," with objectives equaling "ends;" policies and commitments referring to "ways," or "methods or patterns of action" demonstrating commitment to an objective; and programs as "means," or tangible proof of a commitment in the form of resources in support of an objective.[42] This monograph adapts the ends-ways-means construct as a method for connecting the three significant elements of study with the question of whether RC forces are essential to the task of IMINT and geospatial exploitation in support of combatant commanders' strategic and operational intelligence requirements.

Using this model, the combatant commanders' intelligence requirements are the objective, or the "ends." Reserve component forces are a large portion of the tangible, committed resources, or the "means" for supporting combatant commanders' strategic and operational intelligence requirements.

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[39]Permanent Select Committee on Intelligence, House of Representatives, Staff Study.

[40]Ted Davis, LTC (USA (Ret), Robert H. Dorf, and Robert D. Walz, LTC (Ret), "A Brief Introduction to Concepts and Approaches in the Study of Strategy," *Fundamentals of Operational Warfighting: U.S. Army Command and General Staff College,. Department of Joint Military Operations Selected Readings Book,* Vol. 1 C500, Fort Leavenworth, KS, August 2001, L1-A-3 – L1-A-7.

[41]Senge, 174-5.

[42]Davis, Dorf, and Walz, L1-A-3 – L1-A-7.

NIMA represents the "ways," or the processes for exploiting imagery and geospatial data that demonstrate the commitment to the "ends." Figure 2 depicts the concept of ends-ways-means in conjunction with its associated significant elements of study—combatant commanders, NIMA, and the RC—to help answer the question of whether the RC forces are essential to the task of exploiting IMINT and geospatial information in support of combatant commanders' strategic and operations intelligence requirements.

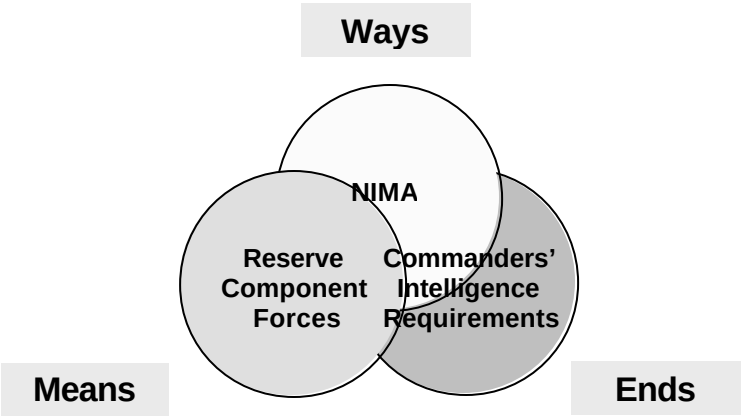

Figure 2: Ends-Ways-Means

As the ends-ways-means construct suggests, the topic of RC forces and combatant commanders' strategic and operational intelligence requirements is a "complex system"[43] that involves elements beyond those identified for study within the context of this monograph. These include budgets, training levels, political climate, lobbies, Congressional leadership, constituencies, domestic economic order, international trends and events, legal constraints, technological advancements, and more. Because they influence the topic at hand, many of these issues will arise within the monograph.

[43]Ludwig von Bertalanffy, *General System Theory* (New York: Penguin University Press, 1975). Senge, and M. Mitchell Waldrop. *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Touchstone, 1992). Using examples varying from the interaction of chromosomes to the myriad of inputs into a business process, authors Bertalanffy, Senge and Waldrop each describe ways to bring structure and positive progress to complex interactions that, often being "on the edge of chaos," are potentially receptive to a structure that will achieve a greater degree of "control" over a complex environment.

For the sake of focus, and with the ultimate goal of being able to target areas for improvement, this work focuses on the convergence of the significant elements of study within the construct of ends-ways-means, as defined.

Reserve Component Forces

The first significant element of study is the reserve components of all services—approximately 1.3 million service members, or almost half of the nation's total military force from the Army, Air Force, Navy, Marines, and Coast Guard. Of this number, approximately 10 percent are involved in intelligence, and of these, an estimated 5 to 10 percent focus on IMINT and geospatial information. In the 18 months following the 11 September 2001 attacks, more than 90 percent of these RC service members have deployed in support of Operation Enduring Freedom (OEF). Currently, RC forces account for 30 to 60 percent of the IMINT production at the combatant commands.[44] Regardless of the service or component within the RC, all reserve manpower is assigned to one of the following three categories: the Ready Reserve, the Standby Reserve, and the Retired Reserve. This study focuses on imagery analysts who are members of the Ready Reserve, and distinguishes types of RC analysts as follows: IAs who train as members of a unit, usually remotely, and IAs who deploy to a geographic location in direct support of a combatant command. Reserve component forces represent the committed resources, or the "means" of supporting combatant commanders' strategic and operational intelligence requirements.

The concept of using RC forces for real-world mission-accomplishment is not new, even in peacetime. The past decade has highlighted an increased interest in utilizing RC forces in the intelligence field. In January 1995, the Deputy Secretary of Defense directed each of the services to establish a plan to "increase peacetime use of Reserve Component (RC) Intelligence elements."[45] The

[44]Meyer, interview, 13 March 2003.

[45]Headquarters Department of the Army. "Peacetime Use of Reserve Component Intelligence Elements: Implementation Plan for Improving the Utilization of the Army Reserve and Army National Guard Intelligence Forces," HQDA, ODCSOPS. DAMO-ODM, 30 June 1995.

plan outlined "procedures, requirements and responsibilities to increase wartime readiness of the Reserve Military Intelligence force."[46] The plan specifically recommended increased and sustained use of RC forces in real-time intelligence production activities. In September of 1997, the Secretary of Defense issued a memorandum entitled "Integration of the Reserve and Active Components."[47] In this memo, Secretary of Defense William Cohen called upon the civilian and military leadership of DOD to eliminate "all residual barriers, structural and cultural" to effective integration of the reserve and active components into a "seamless Total Force."[48] These and other documents highlight increased attention on employment and integration of RC forces in a climate of militarydrawdowns following the Cold War.

In response to Office of the Secretary of Defense (OSD) guidance to integrate active and reserve forces and to increase use of RC forces within the intelligence community, the Assistant Service Secretaries for Reserve Affairs developed the Joint Reserve Intelligence Program (JRIP) Strategic Plan. Included in this plan was the development of 28 Joint Reserve Intelligence Centers (JRIC) where RC forces would be able to contribute directly to combatant commanders' strategic and operational intelligence requirements from remote locations. JRICs offer access to secure compartmented information facilities (SCIF), plus access to required databases and technological tools required to perform all-source intelligence analysis to include IMINT, MASINT and geospatial information. The Director of the Defense Intelligence Agency (DIA) endorsed the creation of the Joint Reserve Intelligence Program (JRIP). Because 43 percent of the total DOD intelligence force resides within the RC, the JRIP Strategic Plan states that operational integration of RC intelligence capabilities with the active force is no longer just an attractive goal; it is a necessity.[49]

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[46]Ibid., 2.

[47]Office of the Secretary of Defense, "Integration of the Reserve and Active Components," Secretary of Defense William A. Cohen, 7 September 1997, http://www.ngaus.org/resources/cohenmemo.asp.

[48]Ibid.

[49]Defense Intelligence Agency, "The Joint Reserve Intelligence Program Strategic Plan," (Washington, DC: GPO, 1998), 4.

One of the goals in setting up the JRICs was to implement processes to "employ reservists without deploying them."[50] Marines, sailors, airmen, and soldiers working at the JRICs may contribute to the combatant commander's mission during annual training (AT), during weekend drills, or while deployed. Some reservists currently deployed in support of OEF are located at their home station, working at a JRIC, and communicating with combatant commands using reachback tools. The JRICs at Fort Leavenworth, Kansas, and at Fort Lewis, Washington, are examples of facilities where imagery analysts have been deployed in support of OEF.

In many cases, each JRIC has a primary supported organization, often a combatant command, "that is commensurate with the predominant skills and organizational relationships of those RC intelligence units and individuals that drill at each specific JRIC."[51] These relationships will be examined in greater depth in the section describing the interface between combatant commanders and RC intelligence resources.

Combatant Commands

The second significant element of study is the nine U.S. combatant commands—Southern Command (SOUTHCOM), European Command (EUCOM), Pacific Command (PACOM), Central Command (CENTCOM), Joint Forces Command (JFCOM), Northern Command (NORTHCOM), Strategic Command (STRATCOM), Transportation Command (TRANSCOM), and Special Operations Command (SOCOM). The combatant commands are the war-fighting headquarters that cover the world geographically and functionally. Each of these commands has a J2 staff responsible for intelligence policy and a JIC or JAC responsible for intelligence analysis. The JICs and JACs, as the analytical intelligence arm for the combatant commanders, represent the intelligence requirements for each of the combatant commands for the purpose of this study. Since it is the combatant

[50]Ibid., 13.

[51]Ibid., 15.

commanders' strategic and operational intelligence requirements we are looking to effectively fulfill, they are the "ends."

National Imagery and Mapping Agency

The third significant element of this study is the National Imagery and Mapping Agency (NIMA). NIMA is the DOD combat support agency responsible for providing "timely, relevant and accurate imagery, imagery intelligence, and geospatial information in support of national security objectives."[52] NIMA's primary customers are combatant commanders and national policymakers. NIMA potentially provides the methods or patterns of action that affect combatant commanders' strategic and operational intelligence requirements, and serves as the "ways" for fulfilling the "ends."

The creation of NIMA represents one of most significant examples of transformation in the intelligence community in recent years. Congress passed the National Imagery and Mapping Agency Act of 1996, which made NIMA the functional manager for imagery intelligence and geospatial information.[53] NIMA combined the Central Imagery Office, Defense Dissemination Program Office, National Photographic Interpretation Center (NPIC), and the Defense Mapping Agency (DMA), plus elements of IMINT shops from CIA, Defense Airborne Reconnaissance Office (DARO), National Reconnaissance Office (NRO), and DIA's office of Imagery Analysis into a single organization. This was a positive step toward consolidating IMINT and geospatial imagery requirements.

More recently, NIMA has begun to integrate intelligence analysis from imagery-derived MASINT into its functional management responsibilities. NIMA has a visionary, forward-looking strategy that effects its contribution and leadership in the area of RC to IMINT and geospatial information.

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[52]Report of the Independent Commission on the National Imagery and Mapping Agency, 10.

[53]10 *US Code*, chapters 22-444 to 467 *and Public Law 104-201, National Imagery and Mapping Agency Act of 1996*, 11 *U.S.C.* 1101 to 1124.

Relationships between Ends-Ways-Means

With the primary players identified and with their role within the ends-ways-means construct defined, this study next combines information derived from interviews, literature, and the survey of the JIC commanders in order to better define the relationship between each of the significant elements of study.

Reserve Components & Combatant Commanders' JICs

First, the relationship between the combatant commanders' intelligence arm—the JIC—and the RC will be examined. Congress and DOD have for several years been promoting greater reserve integration into the military services. *Joint Vision (JV) 2010* and *JV 2020*, the QDR, and DOD Directives have called for the removal of all barriers separating active and RC forces. Recently, with Public Law 106, Congress has specifically directed a three-year examination of RC contributions to intelligence. This guidance indicates national-level interest in the importance of the RC to the combatant commanders' strategic and operational intelligence mission. The RC contributes to the "means" for the combatant commands to achieve operational and strategic intelligence objectives.

A recently published article in *Military Intelligence* explains that "the campaign against terrorists is more like a 'marathon' than a 'sprint,'" and that "production of actionable intelligence has surged."[54] In response to this surge, the National Ground Intelligence Center (NGIC) has "activated more than 140 reservists who are an integral part" of the NGIC team.[55] CENTCOM, PACOM and other combatant commands have similarly activated reservists to help meet their needs for increased imagery exploitation support.

The Joint Intelligence Center Pacific (JICPAC) will serve as the first example of RC-combatant command integration. Like most JICs, JICPAC has developed a system for responding to

[54]Robert O'Connell, Ph.D., and Steven White, LTC, "NGIC: Penetrating the Fog of War," *Military Intelligence* 28, no. 2 (April-June 2002), 14.

[55]Ibid., 14.

the shortage of imagery analysts. Major Ronald Senger, Chief of Imagery Intelligence at JICPAC, explains that PACOM's JIC has identified two discrete areas for reserve contribution to IMINT. Specifically, JICPAC relies on six JICPAC detachments (formerly known as Reserve Production Centers) to conduct IMINT work on "third tier type countries," which are of lesser importance to the combatant commander than first and second tier countries. As world events change, the list of third tier countries changes, and the priority of effort is determined at the discretion of the combatant commander.[56] These detachments work out of the JRICs at the reservists' home stations.

JICPAC also uses its reserve detachments to perform supplemental phase imagery reporting (SUPIR). SUPIRs involve looking for changes in installations and facilities of interest to the command. Every two years, DIA reviews and updates the list of SUPIR facilities. To provide additional structure to the IMINT production process, DIA establishes guidelines for how often certain areas get examined for current IMINT. The DOD intelligence production program (DODIP) provides guidance on this topic by prioritizing how frequently the intelligence community collects and processes information.

Like JICPAC, most combatant commands maintain habitual relationships with reserve units who contribute to their IMINT mission. The method each JIC uses for assigning imagery to drilling reservists varies. SOUTHCOM, for example, maintains a habitual relationship with two JRICs—a JRIC at Fort Worth, and a multiple JRIC at Jacksonville and Miami. SOUTHCOM's JIC Commander, Colonel Haygood, explains that with increasing amounts of imagery data under FIA and with IMINT complexity becoming greater, it is the "reservists who are there to step into the breach."[57] Specifically, Colonel Haygood explains that SOUTHCOM imagery analysts rarely focus on fielded forces these days. At SOUTHCOM and at PACOM, for example, the focus is turning to complex global issues involving drugs, insurgents, independence movements as well as transnational terrorist

[56]Major Ronald Senger, USAF, Director of Imagery Intelligence, Joint Intelligence Center Pacific, PACOM, telephone interview by author, 18 November 2002.

[57]Haygood.

groups.[58] Indeed, the IMINT mission has changed dramatically in this decade for all of the combatant commands.

Instead of focusing at the tactical level, IAs at the combatant commands work almost exclusively at the operational and strategic levels. Colonel Haygood explains though, that the JIC structure needs to change to meet improving technologies and the new IMINT requirements. He says that the JIC "structure has not changed since the days of Panama (Operation Just Cause), even though the mission has changed in the last 3-5 years."[59] Marine Major Greg Farry, serving in the CENTCOM JIC, echoes the concern that the JIC structure needs to adapt to meet changing IMINT requirements. He says, "DOD has mandated what CENTCOM should be—25 years ago, yet this is nothing like reality today." Major Farry says that the mission moves more quickly today, and that "what is needed is a 'bottom-up' review of how CENTCOM's JIC should be structured."[60] At the same time, MAJ Farry, a reservist himself, is typical of how reservists frequently fill gaps created by this inadequate structure and the increase in IMINT complexity.[61]

The commander of JIC SOUTHCOM explains that to partially mitigate the anticipated requirement for greater exploitation assets that will come with systems enhancements, imagery architecture will have to include methods for automatically screening raw imagery. "Smart filters will need to be able to highlight changes or indicators that will filter-out that imagery and pop it into an imagery analysts database" for exploitation.[62]

Northern Command is currently in the process of determining its need for reserve component IMINT support. The Department of Defense established U.S. Northern Command in 2002 to conduct

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[58]Ibid.

[59]Ibid.

[60]Major Greg Farry, U.S. Marine Corps Reserve, deployed to CENTCOM in support of Operation Enduring Freedom, serving as the Executive Officer to the CENTCOM JIC, telephone interview by author, 19 November 2002.

[61]Ibid.

[62]Haygood.

operations to deter, prevent, and defeat threats and aggression aimed at the United States, and to provide military assistance to civil authorities, including consequence management operations. While NORTHCOM has few permanently assigned forces, it will have access to forces whenever necessary to execute missions as ordered by the President.[63] The Chief of NORTHCOM's Imagery and Geospatial Analysis Section believes that reservists are potentially important to NORTHCOM. "Because of the expertise they bring from their civilian jobs, reservists may best know precisely what NORTHCOM is trying to understand in its mission of homeland defense."[64] Also, the unique positioning of Title 32 National Guard units may allow NORTHCOM latitude in its mission of providing homeland security. Unlike the active component and members of the reserve who operate under Title 10 restrictions, National Guard soldiers may conduct military operations and policing duties on U.S. soil in direct support of homeland defense.

To discuss the relationship between combatant commanders and RC units, it is important to understand the concept of reachback. While it allows RC forces and other intelligence organizations to contribute to combatant commanders' intelligence requirements from remote locations, commanders have mixed reviews regarding the effectiveness of reachback as a tool for communicating and conducting business with units not located on site with the JIC. Colonel Haygood believes that service culture is part of the problem with integrating reachback into the process of communication between JICs and JRICs, for example. He says that unlike the largest of the services, the Army, the Air Force has more experience, and therefore is more accepting of reachback. Because the Air Force is traditionally a "stand-off force," and because the Air Force uses reachback at the tactical level, "the

[63]NORTHCOM, "Who We Are," http://www.northcom.mil/index.cfm?fuseaction=s.whoweare&section, accessed 6 April 2003.

[64]Dale Auer, Chief, Imagery and Geospatial Analysis Section, NORTHCOM, telephone interview by author, 20 November 2002.

Air Force is more comfortable with this process."[65] The Army, Navy and Marines also use reachback to varying degrees, and each of the services continues to test capabilities and limitations of reachback.

An example of a reachback process that facilitates communication between JICs and RC units working at JRICs is the modernized integrated data base (MIDB), which is accessible across DOD. Emerging doctrine would label MIDB as a form of reachback.[66] The JICPAC detachments and others performing imagery exploitation supporting combatant commands' JICs also communicate with their "parent" units using a variety of means to include classified email such as Secure Internet Processing Response Network (SIPRNET), INTELINK, and Joint Warfare Intelligence Communication System (JWICS), as effective reachback tools.[67]

Seven of the nine respondents to the survey agreed or strongly agreed that, "reachback will become increasingly important in the command's ability to utilize reserve IMINT capabilities." The remaining two respondents provided a "neutral or not sure" response.[68] Recently developed doctrine discusses the importance of a commander's ability "to reach horizontally and vertically" into units at all operational levels both in theater and in sanctuary for IMINT and geospatial information and products "that directly support the mission."[69]

In summary, progress toward RC integration, especially in the intelligence field, has been rapid. Colonel Haygood explains that unlike 15 years ago, it is difficult to tell the difference between a reserve and an active component soldier in terms of professionalism, competence and capability. And, to make the distinction even less, Haygood explains that "reserve forces today have the systems,

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[65]Haygood.

[66]Major John M. Neal, U.S. Army, "39A Look at Reachback," *Military Review*, September-October 2000, http://www-cgsc.army.mil/MILREV/english/SepOct00/neal.asp.

[67]Ibid.

[68]Survey, #24.

[69]TRADOC Pam 525-41.

connectivity, and training that make them of immediate use" to a commander.[70] A July 2002 Congressionally-mandated interim report on reserve contribution to intelligence confirms this impression. "Automation, connectivity, secure spaces, access to current computer systems and applications, and better integration with active forces…have enabled RC intelligence personnel to respond effectively to critical national, theater, and Service requirements."[71]

NIMA and Combatant Commanders' JICs

The next relationship involves the ways of bringing strategic and operational IMINT to combatant commanders, the ends whose operational and strategic intelligence requirements must be satisfied. As the executive agent for IMINT and geospatial information, NIMA provides the policies and resources for maximizing the contribution of IMINT to its users—who include the combatant commanders. NIMA's Strategic Plan corresponds directly with combatant commanders' requirements, and highlights their demands for "more information, tailored to meet specific needs, delivered faster and more economically."[72] The following describes the relationship between NIMA and the combatant commands it supports.

JIC commanders at the combatant commands spoke highly of NIMA and described a close working relationship with this combat support agency. Typically, each JIC has a dozen or more NIMA imagery analysts working on site at their commands, with the senior analyst at each location serving as a liaison to the combatant commander. Consistent with the survey results, everyone interviewed for this study agreed, "NIMA plays an important role in support of the combatant

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[70]Haygood.

[71]United States Congress. *Public Law 106-398, Section 576, Test Program: Reserve Component Intelligence, Transforming an Engaged Force: First Interim Report*, 1 July 2002.

[72]Deputy Chief of Staff for Intelligence, Department of the Army, *Army Intelligence Transformation.* (AI-TCP), (Washington, DC: GPO, August 2001), M-12-13.

command's strategic and operational IMINT requirements,"[73] and further, NIMA has a greater role to play in the future.[74] Commanders report that NIMA's relationship with the military has improved over the past several years. One commander explains, "NIMA's communication with the military commands has improved 100 percent in the last two years."[75] Currently, NIMA produces and distributes a weekly report explaining what NIMA is doing to support the combatant commanders' areas of responsibility (AOR). As NIMA increasingly takes the initiative to take advantage of the RC's ability to contribute to the task of national-level imagery exploitation, it ultimately will be able to provide greater support to the combatant commands.

Reserve Components and NIMA

To fulfill its leadership role as the combat support agency for IMINT, and to better coordinate the effectiveness of RC integration with the active component and other sources of IAs, NIMA recently took the initiative to fund billets and manage a Joint Reserve Unit (JRU) tasked with supporting national-level imagery analysis efforts. Prior to taking this step, a Navy Reserve unit of 30 reservists supported NIMA. The Navy Reserve had funded this unit. The Joint Table of Mobilization and Distribution (JTMD) for NIMA's new JRU authorizes 361 members. This is a 1200 percent increase from the 30 reservists who supported NIMA's IMINT and geospatial intelligence analysis missions in the past.[76] NIMA had been working on the JTMD since 1998, and was guided by the director of NIMA's assessment of NIMA's ability to satisfy IMINT requirements associated with combatant commanders' operations and contingency plans. Typically, each of the services would fund such a JRU. When the services declared they were unable or unwilling to fund the new unit of

[73]Survey, #9.

[74]Survey, #10.

[75]Haygood.

[76]Pat Warfle, Chief of Office of Corporate Relations, NIMA, and Commander, NIMA Reserve Unit, telephone interview by author, 29 August 2002.

IAs, NIMA took the unprecedented step of deciding to buy billets to support the new JRU. Of the nine combat support agencies, NIMA is the first to fund billets that each of the services would normally pay for, to establish a reserve unit directly supporting its IMINT and geospatial information mission.

In addition to standing-up this new unit, NIMA recently committed $2.3 million to augment class sizes for entry-level IA training. Both the new JRU and the commitment to entry-level training are important initiatives that will help ease the burden on the limited pool of exploitation assets. Navy Reserve Commander Pat Warfle will command the new JRU. He explains that the events of 11 September 2001 made the difference in getting Congressional support for funding through Defense Expenditures for Reserve Forces (DERF) to support this new unit.[77] Funding for NIMA's JRU and for the additional training slots is part of the $40 billion Congress provided to DOD following the events of 11 September. The expanded JRU exemplifies how NIMA is working with the RC to contribute to IMINT and geospatial information support for the combatant commanders. The linkage between each of these entities demonstrates how each interacts to support the "ends," or the combatant commanders' strategic and operational IMINT requirements.

This study has presented the geopolitical context for the exploitation of IMINT and geospatial information. Additionally, the study has described and identified the step within the IMINT production cycle requiring the most attention in order to meet the needs of the geopolitical context. Further, the study has identified, defined, and described the relationship between the significant players representing the ends-ways-means that lead to an understanding of whether RC forces are essential to the task of IMINT and geospatial exploitation in support of combatant commanders' operational and strategic intelligence requirements. Last, this monograph has reviewed Congressional mandates, DOD policy, technological advances, and observations of leaders within the intelligence community to help determine whether RC forces are essential to the task of performing IMINT and

[77]Ibid.

geospatial information in support of the operational and strategic intelligence requirements. The following reasons summarize why the RC is important for achieving the combatant commanders' ends:

1) The post-Cold-War geopolitical situation has led to a greatly increased number of countries and entities requiring geospatial and IMINT attention. Combatant commanders' demands for IMINT and geospatial information have increased in order to meet the breadth of threat within their AOR.

2) Future Imagery Architecture is leading to a greater supply of raw imagery data, which exacerbates the problem of a shortage of IAs and further stresses the exploitation element of TPED.

3) The overall decrease in military personnel as part of the militarydrawdowns of the mid-1990's in part led to a decreased supply of imagery analysts available to exploit the increasing quantity, quality and breadth of imagery and geospatial information. Imagery analysts, for all services, are considered "high-demand, low-density" assets.[78]

4) The Department of Defense has called for total integration of reserve and active component forces. Additionally, a call for Peacetime Use of Reserve Components advocates using RC forces in peacetime and in war. Further, the Reserve Forces Policy Board has recommended that the nation place "maximum reliance on the reserve components and, when utilized, put them as close to the fight as possible."[79]

5) JIC commanders recognize the increasing role of the RC in light of the increased demand for IMINT and geospatial intelligence in support of combatant commanders' strategic and operational intelligence requirements. Illustrating this fact is that more than 90 percent of RC intelligence personnel have deployed in support of OEF in the past two years.

6) JIC commanders universally agree that RC forces "bring unique value to the command" based on their civilian work experience, and on their functional and regional expertise.[80]

7) Using the RC has inherent efficiencies from a cost-effectiveness standpoint. The Reserve Forces Policy Board recently concluded that, "combat capability can be cost effectively maintained in the reserve components if resourced and trained at the proper level."[81]

These reasons prove the importance of the RC to combatant commanders' operational and strategic intelligence requirements. Plus, with the large numbers of RC intelligence forces who have

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[78]Meyer, 13 March 2003.

[79]Report of the Chairman of the Reserve Forces Policy Board, available from http://www.intellnet.org/resources/dod_annual_report_1998/rfpb.html, accessed 2 February 2003.

[80]Survey, #19.

[81]Report of the Chairman of the Reserve Forces Policy Board.

served in support of OEF—98 percent, it follows that the RC likely plays a vital role in supporting combatant commanders' operational and strategic intelligence requirements. Nonetheless, these facts alone do not necessarily prove the RC is essential to satisfying combatant commanders' operational and strategic intelligence requirements. What makes the RC essential is the coupling of the reasons listed above with the unique contribution the RC makes to demonstrate the country's commitment to military endeavors. Using terminology from operational planning, the RC serves as a critical capability[82] of the U.S. military, which serves as a catalyst for garnering support for U.S. military action. Military planners often identify national will and support of an operation as a strategic center of gravity to be protected to ensure success of a military plan. This is a lesson learned followingthe Vietnam War, when the nation demanded that citizen soldiers serve alongside members of the active components in order to lend legitimacy and commitment to the nation's endeavors. Even more important, following the events of 11 September and the establishment of NORTHCOM, the National Guard element of the RC provides a unique ability for the U.S. military to perform law enforcement duties within the United States under Title 32 to ensure national security. As the Reserve Forces Policy Board has articulated, "Utilization of the reserve components against threats to national security promotes national will."[83] This is ultimately the reason that RC forces are essential to the task of exploiting IMINT and geospatial information in support of combatant commanders' strategic and operational intelligence requirements.

Given this foundation of reasons for the RC's importance and essential nature, the question arises regarding how to most effectively manage limited IMINT and geospatial information exploitation resources to most effectively and efficiently meet combatant commanders' operational and strategic intelligence requirements. The timing for providing a recommendation for maximizing

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[82]Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory*, (Portland, OR: Frank Cass, 1997). Naveh describes a system of "critical capabilities" that comprise a "center of gravity" for a complex system.

[83]Report of the Chairman of the Reserve Forces Policy Board.

RC contribution is now. DOD's *Reserve Component Employment Study 2005* calls for an in-depth study of RC forces to include a requirement for each of the services and combatant commands to "develop and assess alternative employment roles and force-mix concepts, including an evaluation of costs, benefits and risks for each option."[84] The following chapter recommends a tool for designing a "force-mix concept" that is dynamic and that optimizes existing analytical power in support of combatant commanders' operational and strategic intelligence requirements. As a CIA report states, "optimal use of existing analytical manpower is critical to national security."[85]

[84]Reserve Component Employment Study 2005, vol. 1 Study Report, http://www.defenselink.mil/pubs/rces2005_072299.html, 3/32, accessed 12 February 2002.

[85]CIA, *Strategic Investment Plan for Intelligence Community Analysis.*

CHAPTER 4

RECOMMENDATION

> The versatility and economic impact of linear programming in today's industrial world is truly awesome.[86]
>
> Eugene Lawler

This recommendation has two parts. Part one includes the development of a matrix that borrows a concept from a CIA initiative to help "prioritize the demands of its wide range of consumers."[87] Two years ago, the CIA recognized the need to develop a matrix to more efficiently and effectively assign intelligence production capabilities in a way that would maximize benefit to its national-level customers. According to the CIA vision, "a matrix approach to aligning priorities and analytical resources could ensure that the unique—and critical—intelligence and analytical requirements of commanders…are not degraded in the search for common requirements and all-encompassing priorities."[88] The CIA-envisioned matrix would assign "specific production responsibilities" to various intelligence organizations, taking "full advantage of complementary capabilities and opportunities for synergy."[89] Since the findings and recommendations of this monograph largely mirror those that the CIA identified in the larger intelligence community, and because the objectives are shared—namely, optimization of analytical resources—this matrix will serve as a conceptual tool for aligning available exploitation assets with combatant commanders' strategic and operational IMINT requirements. Instead of focusing on national-level policymakers as the CIA suggests, the model proposed here addresses combatant commanders' strategic and operational intelligence requirements.

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[86]Eugene Lawler, http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Dantzig_George.html, accessed 4 April 2003.

[87]CIA, *Strategic Investment Plan for Intelligence Community Analysis.*

[88]Ibid.

[89]Ibid.

Part two of this recommendation proposes that the matrix serve as a basis for a linear programming model to aid in aligning combatant commanders' strategic and operational intelligence requirements with the most effective analytical resource. Consistent with the CIA vision for the intelligence community, the linear programming model would use "the matrix to fine-tune analytical production," and the model would serve as "an iterative process sensitive to changing customer requirements, advances in technology, lessons learned, and rigorous evaluation of results."[90] The linear programming model used in this monograph focuses on IMINT and geospatial analysis, its analytical resources, and on its exploitation assets relative to combatant commanders' operational and strategic intelligence requirements. For the purpose of this model, an exploitation asset is an individual trained to process raw imagery, or fulfill the exploitation element of the IMINT production cycle, TPED. Exploitation assets identified in this study are IAs on active duty, mobilized RC IAs, RC IAs not on active duty (IMA, IRR, TPU), DOD civilians; contractors; commercial sources, and topographic engineers.

Consistent with the CIA proposal, the linear programming model is dynamic. It is an iterative process whereby output variables, as well as the mix of exploitation assets change as mission requirements change. Furthermore, the model allows for coefficient modifications that reflect changes in asset utilization characteristics such as training, security-clearance requirements, or working conditions, for example. The goal here is to present a tool for re-allocating analytical IMINT and geospatial information requirements across available exploitation assets, to include the RC, in order to maximize total intelligence output in support of a combatant commander's strategic and operational intelligence requirements.

Before launching into the specific recommendations, the initial problem statement that must be solved is:

$$\sum \boldsymbol{Y} < \sum \boldsymbol{Y'}$$

[90]Ibid.

Where: ***Y*** = the amount of output by all imagery intelligence exploitation assets, and

> ***Y'*** = the amount of output needed to satisfy combatant commanders' strategic and operational IMINT and geospatial information requirements.

The model is designed to maximize the value of output by all exploitation assets, in order to approach the output needed to satisfy combatant commanders' IMINT and geospatial information requirements. The problem is solved when the available assets are utilized in such a way that maximizes the value of the output to the combatant commanders. With this restatement of the problem and eye on the goal, the following describes linear programming and its application to IMINT exploitation assets and combatant commanders' strategic and operational IMINT requirements.

The model proposed here has its origins in military operational planning. Linear programming is the brainchild of George Dantzig, who was head of the Combat Analysis Branch of the Statistical Control Division for the U.S. Air Force during World War II. In 1947, Dantzig developed a method of "simplex optimization," today commonly known as linear programming. "Dantzig mechanised the military planning process by introducing 'linear programming'."[91] According to historians, Dantzig's optimization method "grew out of his work with the U.S. Air Force where he became an expert on planning methods solved with desk calculators. In fact this was known as 'programming,' a military term that, at that time, referred to plans or schedules for training, logistical supply or deployment."[92] Dantzig reflects on his work with Air Force planning efforts during World War II by describing, "Everything was planned in greatest detail: all the nuts and bolts, the procurement of airplanes, the detailed manufacture of everything. There were hundreds of thousands of different kinds of material goods and perhaps fifty thousand specialties of people. My

[91]George Dantzig, http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Dantzig_George.html, accessed on 4 April 2003.

[92]Ibid.

office collected data about the air combat such as the number of sorties flown, the tons of bombs dropped, attrition rates."[93]

It was from this planning experience that Dantzig developed his asset optimization model, known as linear programming. Since its development in the 1940's, the military has used Dantzig's linear programming model in a variety of ways. Many attribute the success of the 1948-49 Berlin Airlift to a coupling of airpower maturity and Dantzig's linear programming model that served as a planning foundation for the operation's logistical processes.[94] The military continues to apply optimization methods using linear programming models. Industry also uses linear programming to maximize efficiency and effectiveness of processes in order to increase bottom-line profit. The following describes linear programming and its potential for application within the IMINT and geospatial information environment.

Linear Programming Model

Consider a typical production-planning problem for a manufacturing plant that builds seven different models of cars. The goal of the company is to maximize the combined profit of its total production of all car models, while maintaining a market for each model. In order to do this, the manufacturer determines the quantity of each model it will produce on each production line in a way that maximizes profit to the manufacturer and best utilizes the capabilities of the manufacturing plant itself. By balancing competing objectives of maximizing profits, satisfying the customer, and by maintaining a foothold in all important (or potentially important) markets, the manufacturing plant will derive maximum value. The company balances competing objectives to best utilize its manufacturing assets to produce the most profitable mix of models. Similarly, in the business of exploiting imagery information, there is a need to ensure that the manufacturing assets (exploitation assets) most

[93]George Dantzig, http://www.e-optimization.com/directory/trailblazers/dantzig/interview_ww2.cfm, accessed 4 April 2003.

[94]Ibid.

effectively match each intelligence product, to ensure that a JIC commander is not expending valuable exploitation assets on one product at the expense of the overall value of all products. For the purpose of describing the model, $\boldsymbol{X}$ equals the exploitation asset, and $\boldsymbol{Y}$ equals the operational and strategic intelligence product resulting from the work performed by the asset. For the purpose of this model, the combatant commander acts as the manufacturing plant desiring to maximize profit, or intelligence value, to meeting the command's operational and strategic intelligence requirements. The six different types of intelligence outputs represent the different car models.

The matrix in figure 3 categorizes the six different types of intelligence outputs, represented as $\boldsymbol{Y}_1$, $\boldsymbol{Y}_2$, $\boldsymbol{Y}_3$, $\boldsymbol{Y}_4$, $\boldsymbol{Y}_5$, and $\boldsymbol{Y}_6$. The matrix also identifies seven discrete exploitation assets, represented as $\boldsymbol{X}_1$, $\boldsymbol{X}_2$, $\boldsymbol{X}_3$, $\boldsymbol{X}_4$, $\boldsymbol{X}_5$, $\boldsymbol{X}_6$, and $\boldsymbol{X}_7$. Additionally, the matrix identifies asset utilization characteristics that affect the capability of different exploitation assets to produce different outputs. These characteristics include reachback viability, security clearance investigation requirements, and training requirements.

As different car models yield different profits, different imagery-derived products yield different values relative to each other, based on the combatant commanders' operational and strategic intelligence requirements. A sport utility vehicle (SUV) commands a high price because it has value to someone needing a heavy, four-wheel-drive vehicle to conduct work in the winter, just as port and airfield information may have value for a planner on a combatant command staff who needs this information to plan the mobilization phase of an operation. Similarly, indications and warning intelligence may be of higher value to a combatant commander when a "crisis action team" is activated and immediate awareness of a developing situation is vital. Another model of intelligence and geospatial information may include data on airports, port facilities, navigable waterways and road networks that have high value when a military operational planner has been presented with an isolated theater for deploying troops. As with the markets, a strategic or operational requirement exists for each type of intelligence output. Also, the value of each type of intelligence output relative to other outputs varies. These relationships change over time, reflecting changes in the market for strategic and operational intelligence requirements. Nonetheless, given market conditions and potential

changes in the world economy, both the car manufacturer and the intelligence community need to maintain the full array of models, or intelligence production outputs.

Categorization Matrix: IMINT & Geospatial Information													
Y							***X***						
Intelligence output		**Asset utilization characteristics**					**Exploitation Asset**						
Output Type		**Key Element**	**Timeframe required**	**Reachback limitations**	**Security clearance required**	**Training time**	**ActiveDuty** 1	**ResDeployed** 2	**ResUnit** 3	**DODCiv** 4	**Contractor** 5	**Comm'l** 6	**Topographic Engineer** 7
I&W	1	Patterns	High	High	High	High	x	x		x			
Geospatial Information	2	Topography, Navigation, SLOCs, APODs, LOCs	Low	Low	Low	Low	x	x	x	x	x	x	x
Order of Battle	3	Weapons & Equipment	Med	High	Med	Med	x	x	x				
Urban Terrain	4	Populations, LOCs & Architecture	Low	Med	Med	High	x	x	x	x		x	x
Terrorist Camps	5	Weaponry, equipment and training activities	High	High	High	High	x	x		x			
Drug Trafficking	6	Agriculture and import-export	Med	Med	Med	Med	x	x	x	x	x		

Figure 3: Conceptual Categorization Matrix

Depending on market conditions—supply and demand—and anticipated changes in the geopolitical context, each intelligence product commands a different profit, or value. For example, a combatant commander may give geospatial information premium value for a given period of time, or for a given project or crisis. The variables $\boldsymbol{c}_1$, $\boldsymbol{c}_2$, $\boldsymbol{c}_3$, $\boldsymbol{c}_4$, $\boldsymbol{c}_5$, and $\boldsymbol{c}_6$ represent the profit contributed by the production of a particular IMINT or geospatial output. Therefore, we represent the objective, or

maximum value to the combatant commander, with the expression $\boldsymbol{c}_1\boldsymbol{Y}_1 + \boldsymbol{c}_2\boldsymbol{Y}_2 + \boldsymbol{c}_3\boldsymbol{Y}_3 + \boldsymbol{c}_4\boldsymbol{Y}_4 + \boldsymbol{c}_5\boldsymbol{Y}_5 + \boldsymbol{c}_6\boldsymbol{Y}_6$.

As discussed, market conditions, or changes in the geopolitical environment, drive decisions regarding combatant commander's intelligence production requirements, regardless of whether or not it brings immediate or tactically high value. The vagaries of geopolitical change require the combatant commander to maintain a foothold in the entire market—as defined as the combatant commander's geographic or functional AOR—even if the value of a given market segment may be lean for the time being. In other words, there is a need to establish a minimum output constraint for each model, or type of imagery output. Similarly, we want to guard against exploiting imagery beyond what a combatant commander would require. To satisfy a commander's minimum and maximum requirements, we provide minimum and maximum constraints on the linear programming model's outputs. These constraints are represented by $\boldsymbol{minY_1}$, $\boldsymbol{minY_2}$, $\boldsymbol{minY_3}$, $\boldsymbol{minY_4}$, $\boldsymbol{minY_5}$, and $\boldsymbol{minY_6}$, and $\boldsymbol{maxY_1}$, $\boldsymbol{maxY_2}$, $\boldsymbol{maxY_3}$, $\boldsymbol{maxY_4}$, $\boldsymbol{maxY_5}$, and $\boldsymbol{maxY_6}$. The problem would thus be written as follows. Maximize profits of $\boldsymbol{c}_1\boldsymbol{Y}_1 + \boldsymbol{c}_2\boldsymbol{Y}_2 + \boldsymbol{c}_3\boldsymbol{Y}_3 + \boldsymbol{c}_4\boldsymbol{Y}_4 + \boldsymbol{c}_5\boldsymbol{Y}_5 + \boldsymbol{c}_6\boldsymbol{Y}_6$ subject to the minimum and maximum production constraints.[95]

Just as the intelligence outputs, $\boldsymbol{Y}$, and their associated profits, $\boldsymbol{c}$, vary, so do the capabilities and efficiencies of their associated exploitation assets, $\boldsymbol{X}$. For example, one imagery analyst, let's say a DOD civilian, may be well-suited to exploit imagery of industrial complexes, but may know little about order of battle. This exploitation asset may be considered $\boldsymbol{X}_1$. Another imagery analyst may be well trained in exploiting order of battle information, but may only be available to work two days per

[95]Mathematically, the total amount of each asset used cannot exceed the amount available å $\boldsymbol{X}_{p,q}$ $\leq$ å $\boldsymbol{X}_p$ where $\boldsymbol{X}_{p,q}$ designates the number of exploitation asset units $\boldsymbol{p}$ expended on the production of output $\boldsymbol{q}$. And, keeping in mind the minimum and maximum production constraints $\boldsymbol{Y}_q \geq \mathbf{min}\ \boldsymbol{Y}_q$ and $\boldsymbol{Y}_q \leq \mathbf{max}\ \boldsymbol{Y}_q$ for each output type $\boldsymbol{q}$. Plus, we need to be mindful of non-negativity constraints imposed by the mathematical technique whereby $\boldsymbol{X}_{p,q} \geq 0$ and $\boldsymbol{Y}_{p,q} \geq 0$ for each exploitation asset $\boldsymbol{p}$ and each output type $\boldsymbol{q}$.

month. This asset may be known as X_2. In other words, each exploitation asset has a different capability or skill.

In order to correct deficiencies, or to expand or to improve production capabilities, the linear programming model allows the combatant commander to make improvements to the JIC's exploitation assets in order for them to more efficiently and effectively produce required intelligence output. This enhancement is called a "conversion factor." By doing so, exploitation assets may produce IMINT and geospatial output in greater volume, or with greater quality. This would directly respond to the increased volume and quality associated with FIA. For example, to increase production of IMINT and geospatial outputs, we may enhance exploitation assets' production capabilities through a variety of means—increasing training opportunities or providing better communication systems, for example. Enhancement of exploitation assets is a key and an important focus of NIMA and others involved in the TPED process. As discussed already, NIMA and other members of the intelligence community have recognized this need and have committed resources toward enhancing exploitation assets. As it relates to this linear programming model, applying an appropriate conversion factor reflects the potential benefit of improved IMINT output in support of the combatant commander's strategic and operational intelligence requirements.

We designate this conversion factor d. Where designated, $d_{p,q}$, is specific to each combination of exploitation assets, p, and imagery output types, q. With conversion factors, we can write the output of each intelligence product in terms of exploitation asset effort spent in the analysis of a given intelligence output. We represent this relationship as $Y_q = \text{å}\ d_{p,q} X_{p,q}$ for exploitation asset type p and output type q. Given the six IMINT outputs in this example, we express the equation for asset-output optimization for each asset as follows:

$$C_1\ \text{å}\ d_{p,1} X_{p,1} + C_2\ \text{å}\ d_{p,2} X_{p2} + C_3\ \text{å}\ d_{p,3} X_{p,3} + C_4\ \text{å}\ d_{p,4} X_{p4} + C_5\ \text{å}\ d_{p,5} X_{p,5} + C_6\ \text{å}\ d_{p,6} X_{p,6}$$

Designating a conversion factor that is specific to the type of IMINT output and to the type of exploitation asset gives the combatant commander a powerful tool in manipulating the relationships

between the production capabilities of the IMINT exploitation assets and the actual quality and quantity of the intelligence outputs. There are several ways in which the conversion factor may vary, each representing a different relationship between the exploitation assets and outputs.

The first relationship is that in the production of the same intelligence product, two different exploitation assets may produce the output with different efficiencies. For example, in an RC unit that produces a specific IMINT output type, $\boldsymbol{Y_q}$, one exploitation asset, $\boldsymbol{X_a}$, is more efficient than another asset, $\boldsymbol{X_b}$, or $\boldsymbol{d_{a,q}} > \boldsymbol{d_{b,q}}$.

A second relationship is one where a particular exploitation asset cannot be used to produce a particular type of IMINT. In this relationship, a specific exploitation asset, $\boldsymbol{a}$, is not capable of performing intelligence output, $\boldsymbol{q}$, or $\boldsymbol{d_{a,q}} = 0$. A non-deployed reserve unit or a private contractor, for example, may not be suited to perform I & W functions.

A third relationship is one where two similar exploitation assets, $\boldsymbol{a}$ and $\boldsymbol{b}$, may be used interchangeably for production of one intelligence output type, $\boldsymbol{m}$, but, only one of the assets may be used in the production of a different IMINT output, $\boldsymbol{n}$. In this relationship $\boldsymbol{d_{a,m}} = \boldsymbol{d_{b,m}} = \boldsymbol{d_{a,n}}$ and $\boldsymbol{d_{b,n}} = 0$. For example, in the IMINT community, several different exploitation assets may produce intelligence output $\boldsymbol{m}$, but, because of the unique characteristics of intelligence output $\boldsymbol{n}$, exploitation asset $\boldsymbol{b}$ may not have the capability of production output $\boldsymbol{n}$, even though it remains able to produce intelligence output $\boldsymbol{m}$.

The combatant commander may adjust the model in order to provide the optimal solution for a particular timeframe, with the values of the coefficients used in the model changing from month to month, or crisis to crisis, to reflect changes in market conditions. This dynamic quality of the model satisfies what JIC representatives at SOUTHCOM, CENTCOM, and other combatant commands call the dynamic battle rhythm for operational planning.

The National Imagery and Mapping Agency and elements of the Department of the Army G-2 are taking active steps to improve the effectiveness and efficiency of imagery and geospatial exploitation. Much of this work, such as utilizing the capacity of JRICs, improving training for RC

IAs, applying reachback tools, integrating geospatial information with IMINT, improving intelligence production cycle communication, and other initiatives represent examples of potential conversion factors, and may be applied to the model's conversion factor ***d***, as described. By doing this, the model remains relevant and reflective of the exploitation assets' capabilities to produce, or satisfy the strategic and operational intelligence requirements of the combatant commander.

In collaboration with work that is being already being done, the linear programming model will help the combatant commander maximize the value of strategic and operational intelligence output. Additionally, the model serves as a tool for integrating RC forces with the active duty consistent with PURC and other DOD guidance. Because the model allows for discrete representation of exploitation types, it discriminates between RC forces deployed, and those who work in a JRIC, for example.

To help visualize the broad array of intelligence markets, NIMA's Inno-vision department, which is looking forward to 2015 and beyond, has created a graphical display that corresponds well with the above-described linear programming model. Figure 4 displays the breadth of IMINT and geospatial information in support combatant commanders' strategic and operational intelligence requirements, plus it gives depth to certain types of operations requiring IMINT and geospatial support. While not a finished product, per se, the graphic helps to determine the minimum and maximum factors for intelligence output types, or ***Y.*** Its application to the management of imagery exploitation parallels well with the linear programming model concept, and lends the model greater usefulness to the IMINT and geospatial information community.

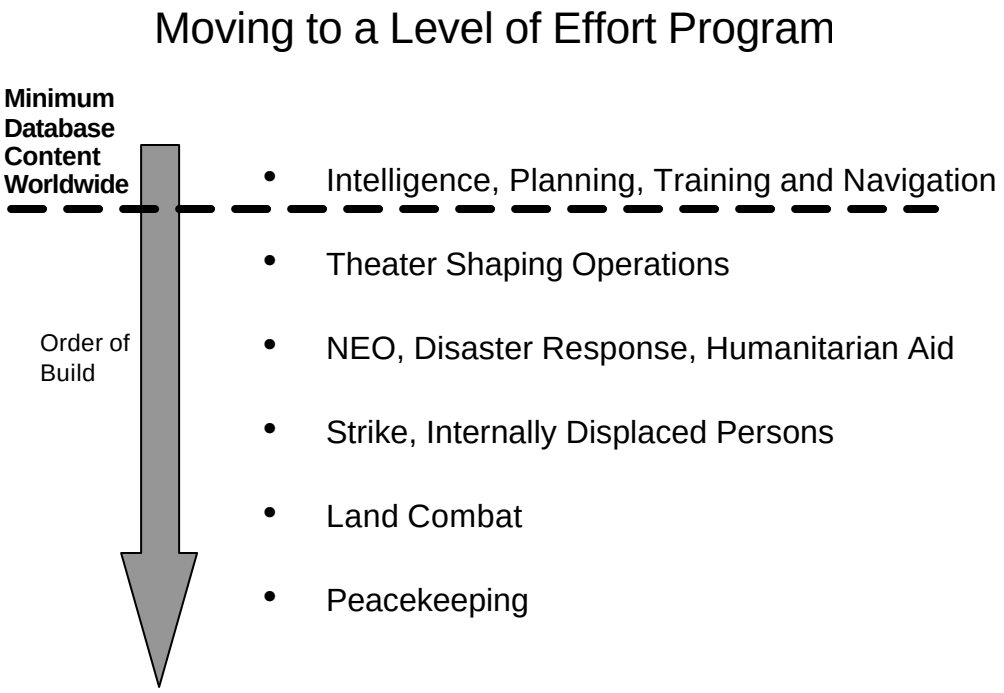

Figure 4: Conceptual Categorization Matrix
Source: Adapted from model provided by Mark Shultz, Deputy Director, Inno-Vision, NIMA, interview by author, 25 November 2002, Bethesda, MD.

Executive Agent

The question then becomes who, or which, of the three significant elements of study within the ends-ways-means construct, is best suited to put this model into practice. Here are two recommendations. The first is to pilot this linear programming model for IMINT and geospatial exploitation asset management at one of the JICs. The model would allow a JIC commander to manipulate and measure the profit, or value, of each type of exploitation asset relative to the intelligence output required. In this way, the JIC commander would act as the manufacturing plant in the linear programming analogy. With this tool, the JIC commander would be able to predict and take steps to fill manpower shortages. The tool also would allow a JIC commander to assess the contribution factor of automated exploitation assets, the feasibility of reachback, and to monitor the contribution of RC forces performing imagery analysis during monthly drills versus annual training or

while deployed. In this way, a JIC commander would be able to balance competing objectives and capabilities of strategic and operational intelligence requirements against the available assets for exploitation.

An alternative recommendation would be for the chief of the NIMA Reserve Forces Liaison office to monitor RC contribution to combatant commanders' operational and strategic IMINT requirements. To do this, NIMA would need to identify what types of output, or intelligence requirements, its exploitation assets support, and to identify the assets needed to satisfy these requirements. If NIMA were to execute this model, the combatant commanders would need to provide NIMA with coefficient data for output value (i.e., the $\boldsymbol{c}$ of the model) to ensure alignment of priorities. With this baseline, the Reserve Forces Liaison office would be responsible for manipulating conversion factor, $\boldsymbol{d}$, to determine the effectiveness of increased training, reachback, and other enhancements to the RC's ability to be more effective in exploiting imagery data that provides valuable "product" for the combatant commanders.

Of these two possible executive agents, the JIC commander is best suited to implementing the model because the commander is more familiar with the ends and is more responsive to the combatant commander's strategic and operational intelligence requirements. The following provides a hypothetical example of how a JIC commander would implement this model to maximize the effectiveness and efficiency of the command's available IMINT and geospatial information exploitation assets.

For the sake of simplicity, let us say that a combatant command has five primary areas of intelligence interest that require exploitation of imagery-derived data, designated $\boldsymbol{Y}_1$ through $\boldsymbol{Y}_5$. One area, $\boldsymbol{Y}_1$, is sea lines of communication (SLOC) information in countries b and c. The second, $\boldsymbol{Y}_2$, is anti-aircraft artillery (AAA) sites in countries h and j. $\boldsymbol{Y}_3$ is to monitor brigade-size training activities of mechanized forces in countries j and k. $\boldsymbol{Y}_4$ relates to the monitoring of nuclear reactor sites in a given country, and a crisis action team has been formed to monitor the situation. Lastly, the

combatant commander continues to monitor the internally displaced persons (IDP) situation unfolding in another region within the command's AOR, designated $\boldsymbol{Y}_5$.

The IDP situation is not immediately threatening to the command's AOR, but because it poses a potential threat to neighboring countries, it has value to the commander—for the sake of this hypothetical example, the commander assigns a value of 10 to this IMINT output. In keeping with the model, $\boldsymbol{c}_5$ represents the value, or potential profit to the command, and $\boldsymbol{Y}_5$ represents the intelligence output produced. The commander assigns a value of 30 each to the SLOC and to the AAA sites, $\boldsymbol{Y}_1$ and $\boldsymbol{Y}_2$, respectively, and a value of 50 to the brigade-sized training activities, $\boldsymbol{Y}_3$. Therefore, $\boldsymbol{c}_1$ and $\boldsymbol{c}_2$ each equal 30, and $\boldsymbol{c}_3$ equals 50. Since it represents the greatest immediate threat, the commander assigns a value of 80 to the value of the nuclear reactor monitoring output, $\boldsymbol{Y}_4$. The commander's collective value of the intelligence output for these activities for this command would be $30\boldsymbol{Y}_1 + 30\boldsymbol{Y}_2 + 50\boldsymbol{Y}_3 + 80\boldsymbol{Y}_4 + 10\boldsymbol{Y}_5$.

The commander now looks to the available exploitation assets to determine which ones are capable of performing these functions. This example will use four asset types: $\boldsymbol{X}_1$ equals active duty assets, $\boldsymbol{X}_2$ represents RC deployed, $\boldsymbol{X}_3$ is RC non-deployed, and $\boldsymbol{X}_4$ is a contractor. The model will reflect the capabilities of each of these asset types through the values of the conversion coefficients, $\boldsymbol{d}$, assigned to each combination of asset $\boldsymbol{X}$, and output, $\boldsymbol{Y}$. Asset $\boldsymbol{X}_1$, for example, has the training, experience, and security clearance to perform any of these outputs, plus the asset is located on site with the command. We would expect that $\boldsymbol{d}$ would be non-zero for all outputs $\boldsymbol{Y}_q$, where q = output type 1 to 5. We would also assign a higher value to $\boldsymbol{X}_1$'s conversion coefficients relative to assets that did not have $\boldsymbol{X}_1$'s training, experience and advantage of being located in close proximity to the JIC. Asset $\boldsymbol{X}_2$, has the experience and security clearance to exploit data on any of these outputs, but this asset's training is not recent, and being less familiar with new equipment, software and techniques, the asset performs exploitation tasks more slowly. Given this fact, asset $\boldsymbol{X}_2$, with current training, is not well-suited to perform work regarding the nuclear power plants in support of the crisis action team's efforts. Even though the lack of updated training may impede asset $\boldsymbol{X}_2$ from working on the crisis

action team, this asset is well suited to work on the IDP, AAA and SLOC pieces. In this example, asset $\boldsymbol{X}_2$ has the highest conversion coefficient for exploiting imagery on AAA sites, since the RCIAs assigned to this mission have been looking at AAA sites in support of this command for a number of years and have superior functional expertise. Similarly, $\boldsymbol{X}_3$, $\boldsymbol{X}_4$, and $\boldsymbol{X}_5$, have conversion coefficients for each output that reflect their specific capabilities. The matrix used for this example will assign conversion coefficients for the model.

It is important to note that training and experience varies widely within each asset type described here. It is not uncommon, for example, for a RC asset to have greater familiarity with a combatant commander's AOR, or significant experience in exploiting imagery on a certain subject matter, than does the reserve component IA's active duty counterpart. In the RC, IAs tend to have greater longevity supporting a given JIC commander than do active dutyIAs, thus making the RC asset better suited to exploiting certain IMINT output types. At the same time, activecomponent IAs often have more recent training than an RC asset. A command employing the model will need to identify and categorize exploitation assets in a way consistent with actual asset-type efficiency and effectiveness.

The coefficients in figure 5 reflect the output each asset can produce in a fixed unit of time; in this example the unit of time is one month. For example, each member of the active duty and contractor asset pools can produce 40 SLOC IMINT products per month. Because their training is not as current, and because performing this function for countries b and c is a relatively new activity for the JIC, the deployed RC assets produce 30. The non-deployed RC have the same training as the deployed RC, but because they are operating in a reachback environment, and average only 3 days per month per person, each asset produces nine SLOC outputs per month. Coefficients of zero, if any, would be due to the need for a certain security clearance, limitations of reachback capabilities, or that an asset is not trained to perform the type of analysis. Coefficients change as the capabilities of the assets change. If an asset attains additional training and better tools to perform a particular type of analysis, its conversion coefficient would increase to reflect that change. Likewise, if better

technology increases the effectiveness of assets in a reachback environment—at a JRIC, for example, the coefficients of those assets would increase to reflect the effectiveness of that asset to the commander's ability to satisfy production requirements in support of the combatant commander's strategic and operational intelligence requirements.

Hypothetical Matrix								
					ASSETS			
					X_1	X_2	X_3	X_4
	Y_{min}	Y_{max}	VALUE c	OUTPUTS	Active Duty	Reserve Deployed	Reserve Non-Deployed	Contractor
					CONVERSION FACTOR d			
Y_1	5	10	30	SLOCs	40	30	9	40
Y_2	10	30	30	AAA Sites	18	34	11	0
Y_3	5	20	50	Brigade-sized Training	20	15	4	0
Y_4	10	50	80	Nuclear Reactor Monitoring	16	5	0	10
Y_5	2	20	10	IDP Monitoring	18	18	3	22
				X_{max}	90	95	12	60

Figure 5: Conversion Coefficient Matrix

Figure 5 also lists the minimum and maximum, Y_{min} and Y_{max}, number of IMINT outputs of each type the JIC commander requires in a given month to satisfy the JIC's IMINT support necessary to fuse with intelligence from other disciplines in order to produce the intelligence requirements in support of the combatant commander's strategic and operational intelligence requirements. The Y_{min} of two for IDP monitoring means that even though this type of analysis has relatively low value, the

JIC commander requires that the situation be monitored biweekly. $\boldsymbol{Y}_{\max}$ indicates the commander's total need for each type of analysis. The $\boldsymbol{X}_{\max}$ values reflect the total number of each asset-type times the number of months the asset is available for performing analysis. This number reflects what industry calls available man-months, or full-time-equivalent (FTE) employees. These values indicate that, in this example, active duty and deployed RC assets are approximately equivalent in their potential ability to perform IA.

The solution the JIC commander is seeking is how many and whattype of exploitation assets to assign toward satisfying IMINT requirements, in order to most efficiently and effectively satisfy the combatant commander's strategic and operational intelligence requirements. Representing the output as $\boldsymbol{Y'}$ for the sum of each $\boldsymbol{Y_q}$ = å $\boldsymbol{d_{p,q}\, X_{p,q}}$ for exploitation asset type $\boldsymbol{p}$ and output type $\boldsymbol{q}$. Mathematically, the problem looks like this:

$$\boldsymbol{C_1} \text{ å } \boldsymbol{d_{p,1}\, X_{p,1} + C_2} \text{ å } \boldsymbol{d_{p,2} X_{p2} + C_3} \text{ å } \boldsymbol{d_{p,3}\, X_{p,3} + C_4} \text{ å } \boldsymbol{d_{p,4}\, X_{p4} + C_5} \text{ å } \boldsymbol{d_{p,5}\, X_{p,5}}$$

Due to the mathematical complexity of the problem, computer software designed to solve linear programming models will produce a solution that maximizes the value to the commander by optimizing asset utilization and planning efforts.

While it is difficult to determine the significance of linear programming to the ability of a JIC commander to more effectively manage, or program, exploitation assets, the vision for applying linear programming to military planning remains. In 1991, George Dantzig wrote, "it is interesting to note that the original problem that started my research is still outstanding—namely the problem of planning or scheduling dynamically over time, particularly planning dynamically under uncertainty. If such a problem could be successfully solved it could eventually through better planning contribute to the well-being and stability of the world."[96]

[96]Dantzig.

To summarize, the two-part recommendation of the matrix and linear programming model directly addresses the problem of a shortage of IAs relative to the amount of IMINT and geospatial information required. The organization responsible for managing such a model is the combatant commander, who as the "ends," knows better than anyone the strategic and operational intelligence priorities, and is thus best positioned to direct the JIC to fulfill those requirements.

While JIC commanders have set up workable ad-hoc relationships with RC units and JRIC sites as described earlier, indications are that management of imagery exploitation assets, no matter whether reserve or active or civilian, is not being fully optimized. Further, changes in the world situation and accompanying organizational changes also indicate greater future reliance on RC forces. All but one respondent to the survey of JIC commanders agreed or strongly agreed with the statement, "Upcoming changes in mission, AOR, or command responsibilities will affect the way this combatant command will utilize reserve forces."[97]

Like most JICs, CENTCOM echoes the overwhelming need for more imagery analysts to support a command with a battle rhythm that one deployed officer described as "crisisdu jour."[98] Survey results match this comment, with 100 percent of the respondents saying that RC forces "bring unique value to the command" because they "allow for 'surge-capacity' of manpower."[99] The survey also revealed that virtually everyone agrees that the RCs "bring unique value to the command" for two other primary reasons: (1) civilian work experience and (2) functional and regional expertise.[100] While CENTCOM's AOR comprises 32 countries, many of these countries are considered "latent" countries, or have countries of significant interest abutting their AOR. CENTCOM uses reservists "to fill-in the blanks" for these countries.[101] There is also significant coordination between the

[97]Survey, #15.

[98]Farry.

[99]Survey, #19.

[100]Ibid.

[101]Farry.

CENTCOM JIC and other JICs to coordinate IMINT and geospatial information on abutting countries in support of current operations.

It is the need for more analysts, coupled with a need to integrate analytical requirements horizontally and vertically[102] across commands and mission requirements, that this recommendation addresses. While it is difficult to quantify the ultimate effect of this recommendation, it is important to remember that in the intelligence arena, "marginal improvements…can spell the difference between success and failure in some individual cases."[103]

[102]Naveh. The author discusses the concept of attacking an enemy's system simultaneously close, and in depth. To borrow this operational concept, the recommendation offered here optimizes simultaneous exploitation of imagery across the breadth and depth of a combatant commander's AOR.

[103]Betts, 147.

CHAPTER 5

CONCLUSION

Optimal use of existing analytical manpower is critical to national security.[104]

CIA's Strategic Investment Plan for Intelligence
Community Analysis, 2000-2001

This monograph has revealed that the RC is essential to the task of IMINT and geospatial information analysis in support of combatant commanders' strategic and operational intelligence requirements, and moreover, that the use of linear programming may provide JIC commanders a tool for optimizing asset utilization in order to most effectively fulfill combatant commanders' operational and strategic intelligence requirements. The following summarizes the five significant conclusions this study has uncovered that highlight the significance of the RC contribution to the task of IMINT and geospatial information. First, the momentum of an increasingly complex and divergent world threat highlights the importance of being able to tap into all sources of imagery exploitation talent. This, coupled with technological advancements such as those associated with FIA puts increasing demands on the IMINT and geospatial information community, where a shortage of exploitation assets exists. Second, DOD has directed increased integration and inclusion of RC forces into peacetime as well as wartime missions. Third, RC forces already have the presence and infrastructure in place to directly contribute to combatant commanders' strategic and operational intelligence requirements as deployed units, or through the JRICs. Fourth, the RC is uniquely positioned to strengthen the national will for supporting military operations. Lastly, by using the linear programming model and associated matrix recommended here, an executive agent—either NIMA or the combatant commands' JICs—may more effectively and efficiently integrate the RC into the process for exploiting imagery data in support of combatant commanders' strategic and operational intelligence requirements. With these

[104]CIA, *Strategic Investment Plan for Intelligence Community Analysis.*

conclusions identified, RC forces are essential to filling the gap between å ***Y***, (***Y*** = the amount of output by all imagery intelligence exploitation assets) and å ***Y'***, (***Y'*** = the amount of output needed to satisfy combatant commanders' IMINT and geospatial information requirements).

Furthermore, this recommendation is consistent with the CIA Strategic Investment Plan that says, in order to "deal successfully with this new threat environment, we must harness technology, manage resources, and invest wisely in people—our most important asset. More than ever, we must ensure maximum cooperation and coordination within the Intelligence Community."[105]

The significance of this monograph goes beyond proving that RC forces are essential to combatant commanders' strategic and operational intelligence requirements. This study reflects the ongoing necessity to continually examine and make improvements in the fields of IMINT and geospatial information. As Ludwig von Bertalanffy describes, "in one way or another we are forced to deal with complexities, with 'wholes' or systems, in all fields of knowledge. This implies a basic re-orientation in scientific thinking."[106] In this spirit, this study has offered a tool for responding to an increasingly complex system in the context of a rapidly changing national security environment. The linear programming model helps guide JIC commanders to systematically direct imagery to the asset most capable of exploiting that data in support of combatant commanders' intelligence requirements based on critical factors such as military orientations, available time, reachback feasibility, security classification, and the combatant commander's assigned value for each type of intelligence output. In this way, a combatant commander may most efficiently and effectively utilize not only RC assets, but all assets available for imagery exploitation in response to a continually changing environment. With this capability in place, the combatant commander may take maximum advantage of an all-source combat multiplier comprising IMINT, geospatial information, and imagery-derived MASINT.

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[105]CIA, *Strategic Investment Plan for Intelligence Community Analysis.*

[106]Bertalanffy, 3.

The creation and application of a linear programming model and categorization matrix that will direct raw imagery to the most appropriate exploitation asset is not a solution limited to the IMINT and geospatial community. Such a model may also be applied to the management of information processed through the ELINT, SIGINT, and MASINT disciplines as well. Interestingly, MASINT and intelligence support to Information Operations are relatively new disciplines within the intelligence community, where the RC has spearheaded contributions that may lead to innovations for the joint intelligence community that most effectively integrate the RC forces into the combatant commands' intelligence production activities.

This study has offered a tool for making continual progress toward improving the management of limited numbers of imagery exploitation assets in support of combatant commanders' operational and strategic intelligence requirements in the context of an increasingly complex threat environment. Most significantly, it is important to recognize that even marginal improvements in the way we conduct business "can spell the difference between success and failure."[107] According to Richard Betts, even if the effectiveness of the intelligence community "increases by only five percent a year," and "the critical warning indicator of an attack turns up in that five percent, gaining a little information would yield a lot of protection."[108]

[107]Betts, 147.

[108]Ibid., 147.

APPENDIX A – SURVEY INSTRUMENT

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September 24, 2002

School of Advanced Military Studies

Joint Intelligence Center Commanders

As part of my studies at the U.S. Army's School of Advanced Military Studies (SAMS), I am writing a monograph to address Reserve Forces' contribution to Combatant Command's strategic and operational IMINT requirements. The paper will study reserve contribution to IMINT currently, in the near-term, and in the long-term. The monograph research methodology will employ a survey of the JICs, and interviews with key personnel at NIMA, Combatant Commands, DIA, and other organizations.

Toward this effort, attached is a survey, which I would be grateful if a representative from each JIC would **complete and return by the close of the conference** directly to Mr. Pat Neary of DIA. Mr. Neary is the Research Director for the Directorate of Analysis and Production at DIA, and has kindly offered to assist in this research effort.

Please note that answers you provide to survey questions will not be attributed to any given command. Instead, data will be presented in aggregate or general terms. The intent is that the information you provide will lead to a better capacity for reserve forces to support your IMINT mission.

If you have questions or comments beyond which may be answered in this survey, please feel free to contact me directly—I will be interested in learning more about your thoughts on this subject. You may reach me at **ann.stafford@us.army.mil.** Thank you for taking the time to share your experience, observation, and expertise on this matter.

Respectfully,

ANN E. STAFFORD
Major, Military Intelligence, U.S Army

Combatant Command J2/JIC IMINT Survey

1. Check the top five strategic and operational requirements for IMINT support at your Combatant Command:

- ☐ **Ethnic conflict**
- ☐ **Drug trafficking**
- ☐ **WMD development**
- ☐ **Monitor agreements/Enforce sanctions**
- ☐ **Conventional weapon development**
- ☐ **Environment/agriculture/health developments**
- ☐ **Political/social/human rights developments**
- ☐ **Traditional military activities/force movements**
- ☐ **Civil War**
- ☐ **Terrorist activities**
- ☐ **Targeting**
- ☐ **Arms trade**
- ☐ **Asymmetric Threats**
- ☐ **Conduct IPB**
- ☐ **Other** _____

15-Mar-03

2. This command has a shortage of imagery analysts.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

3. DOD has a shortage of imagery analysts.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

4. My command relies on reservists to address a shortage of imagery analysts.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

5. Reserve imagery analysts are as able to perform their function as their active duty counterparts.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

Combatant Command J2/JIC IMINT Survey

6. In terms of TPED, rate (from 1-4) which elements will demand the greatest increase or improvement of resources over the next 5-10 years?

Tasking	____
Processing	____
Exploitation	____
Dissemination	____

7. Reserve forces are essential to the task of imagery exploitation in support of this command's strategic and operational intelligence requirements.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

8. Future Imagery Architecture (FIA) and other collection enhancements, plus the increased demands on TPED/TPPU will require greater reserve contribution to IMINT.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

9. NIMA plays an important role in supporting this Combatant Command's strategic & operational IMINT requirements.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

10. NIMA has a greater role to play in supporting Combatant Command's strategic & operational IMINT requirements.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

15-Mar-03

Combatant Command - J2/JIC IMINT Survey

11. Reserve forces have a greater role to play in IMINT in support of this command.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

12. The commercial sector has a greater role to play in IMINT in support of this command.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

13. U.S. allies (Commonwealth) have a greater role to play in IMINT in support of this command.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

14. This Combatant Command sees an increasing need for personnel trained in all-source intelligence analysis.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

15. Upcoming changes in mission, AOR, or command responsibilities will affect the way this Combatant Command will utilize reserve forces.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

16. Future technological developments will require greater reserve contribution to IMINT.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

15-Mar-03

Combatant Command - J2/JIC IMINT Survey

17. Ramp-up time for reserve imagery analysts to mobilize and deploy is shortened based on their contribution to IMINT during normal reserve training.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

18. Reserve forces play an important role in supporting this Combatant Commander's strategic & operational IMINT requirements.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

19. Reserves bring unique value to the command for the following reasons (Check all that apply):

- ☐ **Civilian work experience**
- ☐ **Civilian life experience**
- ☐ **Functional/regional expertise**
- ☐ **Longevity in doing this work**
- ☐ **Citizen-soldier representation**
- ☐ **Allow for "surge-capacity" of manpower**
- ☐ **Organizational, or "tribal" knowledge**
- ☐ **Cost-effectiveness**
- ☐ **Other** _____

15-Mar-03

Combatant Command - J2/JIC IMINT Survey

20. If reserve imagery analysts were better trained, this command would rely on them more heavily.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

21. Reserve contribution to IMINT is consistent with service transformation plans.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

22. Reserve forces are well-suited to conduct imagery and geospatial intelligence analysis.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

23. This command uses "reachback" capability to task and to obtain IMINT products from reserve units.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

24. "Reachback" will become increasingly important in the command's ability to utilize reserve IMINT capabilities.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

15-Mar-03

Combatant Command - J2/JIC IMINT Survey

25. Army Reserve imagery analysts who support this JIC are well-trained to perform their work.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

26. Navy Reserve imagery analysts who support this JIC are well-trained to perform their work.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

27. Marine Reserve imagery analysts who support this JIC are well-trained to perform their work.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

28. Air Force Reserve imagery analysts who support this JIC are well-trained to perform their work.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

29. This command would not be able to conduct its mission without reserve support.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

30. In my opinion, reserve contribution to Combatant Command's operational and strategic IMINT requirements is an important topic to study.

☐ Strongly Agree ☐ Agree ☐ Neutral or Not sure ☐ Disagree ☐ Strongly Disagree

Comments:

15-Mar-03

Combatant Command - J2/JIC IMINT Survey

I am representing the following command:_____

My position is: _____

My service is:

Army	____	**Marines**	____
Navy	____	**DOD Civilian**	____
Air Force	____	**Other**	____

My rank/grade is:_____

My name is: (opt.) _____

My phone number is: (opt.) _____

My email address is: (opt.)_____

The directorate(s) who are involved with reserve IMINT issues at my JIC are:

Name_____
Title_____
Contact Info_____

Name_____
Title_____
Contact Info_____

15-Mar-03

Please advise others who have an interest in this subject and contact information:

_____
_____
_____
_____
_____

The approx. total number of reserve personnel (TPU, IMA, IRR) who support the IMINT mission of this command is:_____

Feel free to contact my office for further assistance or information in support of this research effort.

☐ Yes ☐ No

Comments (Continue on back, or email to me directly at annstafford@us.army.mil):

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